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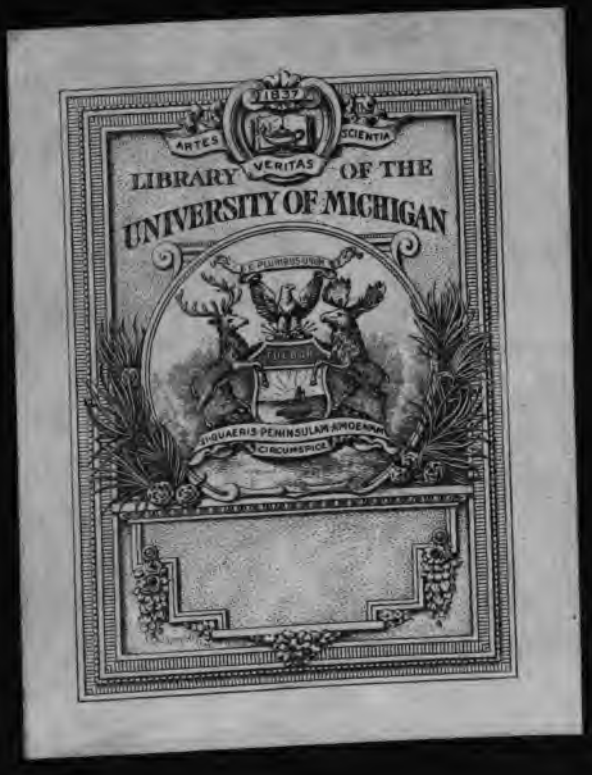
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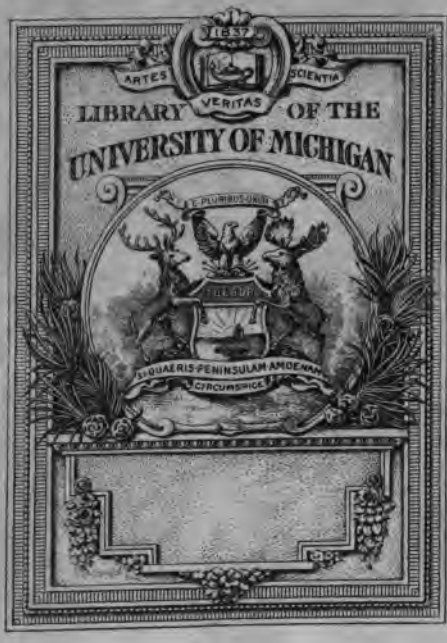
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OF

LONDON.

NEW SERIES. VOL. XIII.

SESSION 1893-94.

LONDON:
SHAW AND SONS, FETTER LANE, E.C.

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LONDON :
PRINTED AT THE BEDFORD PRESS, 20 AND 21, BEDFORDBURY, W.C.

CONTENTS.

On the History of Epidemiology in England. Inaugural Address of Session 1893-94. By JOSEPH FRANK PAYNE, M.D., F.R.C.P., *President* 1

Considerations regarding the Nature of Infection, with special reference to the Action of Bacterial Poisons. By WILLIAM HUNTER, M.D., M.R.C.P. 19

The Aërial Convection of Small-pox from Hospitals. By JOHN C. MCVAIL, M.D., F.R.S.E. 38

A Contribution to the Epidemiology of Cholera in Russia. By FRANK G. CLEMOW, M.D. 60

On Certain Affections of the Mucous Surfaces and their relation to Diphtheria. By S. W. WHEATON, M.D. 83

On the Co-existence, or the Occurrence in Close Succession, of more than one Infectious Disease in the same individual. By F. FOORD CAIGER, M.D., B.S.Lond., etc. 94

On the Distribution of the Mortality from Influenza in England and Wales during recent years. By H. FRANKLIN PARSONS, M.D. ... 114

The Outbreak of Cholera in Mesopotamia and Syria in 1889, 1890, and 1891. By E. D. DICKSON, M.D., Physician to the British Embassy at Constantinople 127

On the recent Outbreak of Cholera in Persia. Report by Dr. CAMPOSAMPIERO, Ottoman Sanitary Delegate at Tehran to the Constantinople Board of Health. Summarised by Dr. E. D. DICKSON ... 154

SUPPLEMENT.

Loimographia: An Account of the Great Plague of London in the year 1665. By WILLIAM BOGHURST, Apothecary. Edited by JOSEPH FRANK PAYNE, M.D., late President of the Society.

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1881. Russell, E. G., M.B., B.Sc., Surg. Ind. Med. Dept.
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1858. Scratchly, G., New Orleans, U.S.A.
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1853. Todd, J. George, Evenwood, West Auckland, Durham.
1885. Tomes, Arthur, Surg. Ind. Med. Service, Bengal.
1873. Townsend, Stephen Chapman, C.B., Surg.-Gen. Ind. Med. Dept., Sanitary Commissioner for Central India.
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1880. Whishaw, J. C., M.D., Surg.-Major Ind. Med. Dept., Lucknow.
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1854. Wiblin, John, The Hermitage, Clewer, Windsor.
1875. Wortabet, John, M.D., St. John's Hospital, Beyrout.

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TRANSACTIONS

OF

The Epidemiological Society of London.

INAUGURAL ADDRESS OF SESSION 1893–94.

On the History of Epidemiology in England.

By JOSEPH FRANK PAYNE, M.D., F.R.C.P., President.

(*Read: November 15th*, 1893.)

Gentlemen,—In taking the chair of this Society for the second time, I thought that it might be of interest to collect some notes relating to the history of the science with which our Society concerns itself. I make no pretension to relating the history of epidemiology, but only wish to bring before you some few episodes illustrating the rise and development of the science in our own country.

The conception and even the name of a science of epidemic diseases began long before with Hippocrates, and his treatise bearing the name of the *Epidemics* has been consciously or unconsciously the model of much that has been written since. The seven books thus named contain, indeed, many things not bearing on epidemics, but we find, especially in the first and third, which are regarded as the only genuine books, the two essential features of epidemic science; firstly, an account of the prevalence of certain diseases in particular seasons and their supposed relation to weather and climatic influences; and, secondly, clinical histories, as we should now call them, of the illnesses of particular patients. Under the first heading comes the description of certain states of the weather and of diseases in particular seasons. Each of these states is called by a name (*κατάστασις*), which was afterwards rendered "epidemic constitution", and each appears to give the history of the seasonal peculiarities of a particular year. Here we have undoubtedly the germ of the idea so prevalent in later writers of a particular *epidemic constitution* impressing a special character upon the diseases of the season in which it prevails, or, again (though this is a more modern idea),

favouring the occurrence of particular diseases. The accurate records of individual cases contained in this work have always been celebrated, and we can only regret that this feature of the writings of Hippocrates was so little imitated by later writers on the same theme. I show you an edition of the *Epidemics* brought out by Freind, the historian of medicine, in 1717.* This work of the father of medicine was copiously annotated by Galen, who valued it very highly, and it always maintained a high reputation; but I cannot now follow the development of the doctrines of Hippocrates in Greek or Roman, or even in early mediæval times. We must plunge at once into that part of medical history which concerns our own country.

Mediæval Medicine.

Mediæval medicine, as we see it first beginning to emerge from obscurity in the thirteenth and fourteenth centuries, offers the greatest possible contrast to the spirit of the age of Hippocrates. I need hardly remind you that such medical knowledge as then existed was a tradition derived chiefly from the Greek and, in a very small degree, from the Latin medical writers, but transmitted through the literature of a totally different race—*i.e.*, the Arabs. Ancient medicine was known in the early Middle Ages chiefly in an Arabian dress. The fathers of Greek medicine, unknown in the original, were read in Latin translations of Arabic works, which were themselves translations or compilations from the Greek. Moreover, such medical science as existed was wholly traditional. Original observation, or the record of first-hand experience, did not exist. It seems to have been impossible for men to record natural facts and appearances as directly observed by their own faculties—the physicians, at all events, did not attempt to do so, and lay-writers often give us better pictures of an epidemic disease. When the doctors wrote about disease it was merely to put down what Hippocrates, Galen, Avicenna, or Razes, or their translators—Constantine and the rest—had laid down on the subject. They never ventured to set their own experience against the dogmatic teaching of the authorities. In this they were often conscientious, probably, and thought that they were serving the cause of truth better by accurately copying the dicta of the ancients than by trusting to their own experience, which was limited, or

* Hippocrates on Epidemic Diseases: De Morbis Popularibus. Edited by John Freind. London, 1717.

to their own senses, which might possibly mislead them. All this was as true of anatomy and of botany as of practical medicine.

Such inordinate respect for authority is certainly not to be found in any of the writers of antiquity, and we can only explain its prevalence in mediæval Europe by a transference to science of the conception of infallibility which was always associated with theology. Whether it was also true of the Arabians, who also possessed an infallible written dogma, I am unable to say. With reference to our particular subject, this slavish habit of mind had, however, one very unfortunate consequence, viz., that it prevented mediæval physicians from making any direct observations which might serve as the basis of a science of epidemics. It is true that they were acquainted with certain diseases not known to the ancients, among which small-pox and measles were the most conspicuous. Many mediæval writers, including the earliest English physicians whose works have been preserved—viz., Gilbertus Anglicus and John of Gaddesden—have left descriptions of these two diseases, and it is interesting to see how they described them. When we look into their descriptions carefully it is difficult to believe that they were founded on actual observation. The symptoms, the causes, and the treatment are given in almost identical language by a whole school of writers, who we find on examination have transcribed them almost literally from the Arabians, especially from Razes and Avicenna. Grüner published in 1790 a valuable collection of the passages of these writers referring to small-pox and measles, though he omitted to quote from Gilbert, and a collation of these passages shows how little originality these writers display.*

Gilbertus Anglicus.

Gilbert, as the earliest English medical writer whose works can be certainly identified, deserves, therefore, a little consideration. A notice of his life may be found in the *Dictionary of National Biography*. There is some difference of opinion as to his date. I myself believe, for reasons which I cannot now give, that he lived at the latter end of the twelfth and beginning of the thirteenth century. He was certainly in the East at the time of the Crusades,

* De Variolis et Morbillis : Fragmenta Medicorum Arabistarum, etc. Edidit C. G. Grüner. Genæ, 1790.

and probably during the third Crusade, that in which Richard I of England took part. His chief work, *Compendium Medicinæ*, exists in two editions, printed abroad, and in MS. copies, of which I am able to show you one to-night.* It was never printed in England, and it does not seem to have been translated into English. It is a systematic Latin text-book, founded on Arabian writers and their copyists. His chapter on small-pox and measles is important, because it seems to have been made use of by later writers, especially by the better known John of Gaddesden. We find here the original indication of Gaddesden's celebrated cure of a royal prince affected with measles, by wrapping him in scarlet cloth and surrounding him with scarlet hangings. It should be stated, however, that Gilbert does not make himself responsible for the advice. Gilbert makes a clear distinction between small-pox and measles; nevertheless, one feels some doubt, as I have remarked before, whether this distinction is based on his personal experience. However, in order that you may judge of this point for yourselves, I will endeavour to give you a short summary of what Gilbert actually says about these diseases, passing lightly over his pathology.

"Variolæ and Morbilli belong to the genus of 'infectious and universal diseases', the only other diseases of this class being 'Morphœa, Serpigo, and Lepra'. But Variolæ and Morbilli also belong to the class of 'Apostemata [that is, matters separated from the blood], and these two are the only 'compound hot apostemata' called by Avicenna pestilential, which follow and accompany fevers, though other apostemata may be followed by fever. They arise from an impure moist matter, shut up in the body, as from impure blood. Nature cleanses the internal organs by driving the poisonous material to the outside, whence the vulgar assert that persons thus affected never become leprous.

"They occur especially at that time of life when heat and moisture abound, or in infancy; often in adolescence, and in the third place in 'juvenes' [young adults up to middle life]." In another place Gilbert says they occur very rarely in the old, but it is not quite clear whether this refers to these diseases generally, or only to one particular kind of eruption.

He says there are four kinds of these diseases. The second is described as "the kind in which the pustules [*i.e.*, spots, not necessarily pustules in our sense] are very small and red, and are properly called *Morbilli* or *Veterana*, and this kind is spotty (*maculosa*). Variolæ and morbilli differ in form and substance. Variolæ are large, and composed of 'coleric' matter, and hence called by Avicenna 'variola colerica'. Morbilli are smaller than variolæ, and do not pierce the skin. Variola makes a projection on the surface." The other three kinds of eruption I will not undertake to discriminate; but they are described as different from variolæ and morbilli.

"The signs of variolæ before the eruption appears are: high fever, redness of the eyes, pain in the throat and chest, cough, itching in the nose, sneezing, irritation or pricking (*punctiones*) in the skin. The disease affects especially

* Gilbertus Anglicus: Compendium Medicinæ. Folio MS. on vellum. Fifteenth century.—The same work. Printed edition. Lyons, 1510.

the upper part of the body, as is shown by pain in the chest, cough, and the like.

"The term *variola* comes from the variety of colour, being sometimes white, orange, green, violet, or black: the more they approach to black the more dangerous they are. *Morbillus* means *morbus minutus*. As to prognosis, some variolæ are harmless, some extremely fatal, some intermediate. One great danger is syncope, or failure of the heart.

"In the treatment, the great thing is to avoid cold; no external applications which might drive the eruption back are to be used. Warm medicines are suitable at first to expel the morbid matter; but if the fever increases after the eruption these are to be avoided, especially if the tongue is rough and black. Venæsection may be employed at first, but not after the fourth day. When the eruption has appeared, wait for its maturation and restoration to health. The pustules are sometimes opened with a golden needle, otherwise they are left to nature, and dry up. Ulcers sometimes occur after variola. There are certain parts which must be especially guarded from harm, viz., the eyes, eyebrows, nose, lungs, intestines, and throat. The eyes are sometimes ulcerated and the sight destroyed. The nose may become ulcerated, and also the œsophagus, so that swallowing may become impossible. The affection of the lungs leads to dyspnœa, and sometimes to phthisis. Ulcers of the intestines cause violent diarrhœa, sometimes intractable and even fatal." Various local remedies are suggested for these complications. The treatment of lung affections is said to be very difficult. Children should have their arms tied to prevent them from scratching. Old women in the country give burnt *purpura** in drink, for it has an occult power of curing variola. Similarly cloth dyed with grain (crimson).

This account is chiefly taken from Avicenna (*Canonis*, Liber iv, Fen. prima, tractatus quartus), and perhaps partly from the works of Razes, but not from the work of the latter now called *De Variolis et Morbillis*, which could not have been known to Gilbert. It is noticeable that Gilbert omits some of the early signs of variola mentioned by Avicenna, such as pain in the back, headache, and mental disturbance. There is no hint in either author of personal contagion. It is evident that parts of the description would apply to measles, scarlatina, small-pox, and perhaps chicken-pox, but it does not give a clear picture of any one of these diseases. How far, therefore, they were actually known to Gilbert I will not now attempt to decide.

John of Gaddesden was the author of a very popular Latin work called *Rosa Anglica*, which was twice printed on the Continent, though never in this country, and is not known to have been translated into English.† His account of small-pox and measles is much like that of Gilbert, but it is remarkable that he quotes the English name "mesles"

* *Purpura* means a shell-fish, used to obtain the crimson (purple) dye; viz.:—*Buccinum lapillus*, the common whelk, or other species. It was long used, or at least spoken of, as a medicinal simple in the Middle Ages, and appears in the first Pharmacopœia Londinensis. The burnt shells were used chiefly as an external application for ulcers and the like; but it is evident they could not have had a purple or red colour, so that there must have been some confusion as to red cloth, and the whole legend may have been founded on a mistake.

† John of Gaddesden: Rosa Anglica. Folio. Venice, 1516.

in his Latin treatise, though in a somewhat ambiguous sense. He does not refer to any distinctive epidemics of this disease, nor does he quote any cases except the one of the royal prince already referred to, so that it is impossible to call his work, any more than that of Gilbert, a valuable contribution to epidemiology. All that we can make out with certainty is that he was acquainted with one or more eruptive diseases, producing red spots or pustules, giving rise to irritation, and likely to leave permanent marks. These he describes traditionally as variolæ and morbilli. But it should be borne in mind that the traditional character of these descriptions given by mediæval writers is no proof of the absence of direct observation. It only proves that these writers were not accustomed to record their own observations at first hand. These two writers are the chief representatives of mediæval medicine in England, as the celebrated John Ardern was of mediæval surgery, and there are others whose works still exist only in manuscript; but it must be confessed that up till the sixteenth century we have no direct observations either on epidemics or on sick persons which can supply any material for a knowledge of the diseases of that period.*

Revival of Greek Medicine.

We must pass on, then, to the time when medicine began to be once again, as it was in the days of Hippocrates, objective, real, and descriptive. European medicine, from the sixteenth century onwards, begins to deserve this character; and in the first place, the question suggests itself, How did the change thus characterised come to be effected? The true answer to this question would be a long one, but briefly we may say that men got out of the habit of slavish respect for written authority, not by neglecting that authority, but by studying it more profoundly. It was the revival of Greek medical literature in the original which, strange to say, brought medicine back to the study of nature. The extraordinary stimulus given by direct study of Greek scientific writers is shown by the fact that these who revived the study of anatomy, like Vesalius, or

* Since this address was delivered, my friend Dr. Norman Moore has kindly given me a reference to the use of the word "Small-Pocks" in a MS. of the *Breviarium Bartholomæi* of John Mirfeld, who lived in the fourteenth century. Dr. Moore says: "The words 'smal pockes' are on fol. 43*a* of the Pembroke College MS. of Mirfeld, near the heading of the chapter 'De Variolis et Morbillis'. The late Professor Chandler [of Oxford] thought the entry contemporaneous."

the study of botany, like Brunfels, Fuchs, Matthioli, and many others, were Greek scholars. They studied Galen and Aristotle without adoration indeed, but not without the deepest respect. This was also true in England of the learned Greek scholar, John Caius, an enthusiastic student of Galen, who first gave an original description of a disease which he had observed himself, uninfluenced by tradition, and where, indeed, he had no traditional authority to guide him.

The Sweating Sickness.

Caius is well known as having described one of the great epidemics of the sixteenth century, the last outbreak of the sweating sickness. On this subject he wrote two books—one in Latin, the other in English. The latter, entitled *A Book or Counsel against the Disease commonly called Sweat*, and published in 1552, though exceedingly rare, has often been quoted; but the Latin treatise *De Ephemera Britannica* is, from a medical point of view, much more valuable. I am able to show you copies of both.* The Latin book, intended for the profession, contains a good description of the symptoms of the disease, from which I will read a short extract, and will venture to give it in English:

"Those whom the disease attacked it tormented in the following way. In some it first seized upon the neck or the shoulder, in others the leg or the arm. Some had a feeling like spirits or warm breath running through their limbs. Along with this, and without any cause apparent to those who were unfamiliar with the disease, a profuse perspiration broke out. The internal parts were first of all warm and afterwards burning, while the heat spread to the external parts of the body. Terrible thirst and restless tossing about followed. The heart, liver, and stomach also suffered from the disease. After all this there succeeded severe headache, with senseless muttering delirium; then drowsiness, and an almost unconquerable desire to sleep; for this disease possesses some virulent poison derived from bad air, which infuriates the mind and then overcomes it with sleep. On the other hand, in those cases in which the sweat was restrained in the first instance there were slight shivers, but afterwards, when the perspiration broke out, it was of a bad odour and colour, differing according to the kind of humour, sometimes scanty, sometimes abundant, but always thick in substance. Some suffered from nausea and some from vomiting, but very few did so, and for the most part only those who had been recently eating. In all the breathing was laboured and rapid, and the voice hollow. If you felt the pulse it was excited and rapid. These were the certain signs of the disease."

Whatever we may think of this as a complete clinical picture, it is certain that no such direct objective account of any disease had before this been written in England.

* John Caius: A Boke or Counseill against the Disease commonly called the Sweate. London, 1552.—John Caius: De Ephemera Britannica. Louvain, 1556.—The same, reprinted. London, 1721.

From Caius we also get some account of the date and extent of the several epidemics of the "sweat", but in this particular he is not more valuable than the lay chroniclers. Haeser, who has reprinted most of the tracts on the sweating sickness, justly places that of Caius in the first rank. I have here some tracts on the "sweat" printed in Germany,* with which it may be compared. Even in the sixteenth century Caius stands almost alone as a recorder of epidemic disease. Dr. Creighton, has, however, made the interesting discovery in the British Museum of a manuscript account in English of the sweating sickness of 1485 by a French physician, Thomas Forrestier, resident in England, and he has given extracts in his important work, the *History of Epidemics*. I have also found in the British Museum one other epidemiological record—a manuscript by a physician named Brandon, of whom little more can be discovered than that he was a medical man—which also furnishes some genuine, though scanty, contributions to epidemiology. Here we find for the first time "annual observations" of diseases, though unfortunately they are very meagre. One very remarkable observation made in the year 1579 I must quote. It is that of an epidemic gangrene—*gangrena endemica*. Brandon says that in Worcestershire and Gloucestershire, towards the end of winter, many lost their limbs by this disease. Some were affected in their hands, but more in their feet; and then he promises to give an account of the *mores et processus* of the disease, but unfortunately at this point the manuscript breaks off. The great importance of this record, however, is that we have here a definite account of what was evidently an epidemic of ergotism—a disease which has always been recognised as being very rare in England, and which has even been thought not to have been observed till the eighteenth century. Brandon also gives observations on epidemic dysentery in 1597 and on the plague of 1603 (Sloane MSS. 166). This leads me to speak of writers on the plague in general.

Literature of the Plague.

The number of publications relating to the plague in Europe during the sixteenth, seventeenth, and eighteenth

* Nuenar et Riquinus: De Novo Morbo quem Sudorem Britannicum vocant. 4to, Cologne, 1528.—Euricius Cordus, Professor in Marburg: Ein Regiment, etc., vor der newen Plage der English Schweyss genant. 4to, Nurmberg, 1529. —Joachim Schiller ab Herderen: De peste Britannicâ commentariolus vere aureus. Basel, 1531; 8vo.—Scriptores de Sudore Anglico. Jena, 1847.

centuries is very large, those in German being probably the most numerous, while those published in England are comparatively few. We might expect, however, that those works published at the time of great epidemics would furnish us with valuable material for epidemic history. It is very disappointing, therefore, to find how very seldom these writings, whether of Continental or English origin, have any historical value. What generally happened was this. When an epidemic broke out or was expected in any particular place, some local physician thought it his business to furnish the public with a tract on the subject, and he accordingly compiled from the best authorities a pamphlet, good or bad, as the case might be. Such a physician, if he survived, would no doubt have been able to acquire some experience of the disease during its continuance, and if he had chosen to put this down in plain words when the epidemic was over, he might have done some service to medical history; but, unfortunately, when the disease had once disappeared, the physician seemed to have lost all interest in the subject, and it is only in rare instances that the medical literature of the plague contains any account of contemporary epidemics. One exception is Guy de Chauliac's well-known account of the "Black Death" at Avignon; but we have nothing in English literature to compare at all with this till much later. The only medical work on "The Plague" in the Elizabethan times which has much value is that of Thomas Lodge, and this cannot be called original. I have brought with me a few similar publications of the seventeenth century and one of the fifteenth, but they are almost entirely destitute of originality.*

It is not till after the great plague of 1665 that we have in the well-known work of Hodges† some attempt at a scientific description of the epidemic. Hodges has so often been quoted that I need not refer to him further, but I should like to mention the name of another medical writer who has left a work on this subject, still in manuscript, in

* Valastus de Tarenta: Tractatus de Epidemiâ et Peste. Mantua, circa 1483.—Orders against the Infection of the Plague, by Queen Elizabeth. About 1590.—Proclamation regarding the Plague, by Charles I. 1641.—Directions for the Cure of the Plague and for Preventing the Infection, set downe by the Colledge of Physicians. London, 1636.—The same Directions. 1665.—Loimotomia, or the Pest Anatomised. By George Thomson. London, 1666.—A brief Treatise of the Pestilence, collected by W. Kemp, M.A. London, 1665.—A Discourse of the Plague. By Gideon Harvey, M.D. 1665.—A Plain and Easie Method for the Plague. By Thomas Willis. London, 1691.

† Loimologia, sive Pestis Narratio. Authore Nathanael Hodges. London, 1672; 8vo.

the British Museum, which deserves to be better known. When I was writing the article on "The Plague" for the *Encyclopædia Britannica* I came across this treatise by William Boghurst, a London apothecary. It is called *Loimographia, or an Experimental Relation of the Last Plague in the City of London*, by William Boghurst, Apothecary in St. Giles-in-the-Fields; London, 1666. It was evidently prepared for publication, but does not appear to have been printed. Either the printed edition has been lost, or else Boghurst did not succeed in finding a publisher. This work shows, I think, a genuine power of observation, and it has the appearance of being perfectly veracious.

Boghurst gives a view of the epidemic which does not altogether agree with that of Hodges, and which is in some respects much more rational. I have here a transcript of some of the most important chapters of the manuscript, from which I will read a few extracts.

This is Boghurst's preface to the reader:—

"Having collected a few scattered observations during my practize upon the plague which continued these eighteen months—viz., from the 7th of November 1664, to the latter end of this May last passed, 1666, and some of my acquaintance being desirous to see them, considering that none hath printed anything either since this plague, or that forty years since (which I something wonder at), for those two or three bockes printed last yeare about the middle of the plague, or a little before, as Mr. Kemp's booke and Gideon Harveye's, Mr. Garencier's, and three or four other small things spoke nothing from experience. . . . I have written nothing from hearesay or from bookes or from the testimony of others or my own conceit, but all and only from experience and triall; and I had one more advantage to doe this, being not at all fearfull, but rendering myselfe familliar to this dissease as to any other, whereas many because of their fearfullnesse came not to close practize, but stood shivering at a distance, and profited the lesse both themselves and their patients, and commonly lost their lives to boot."

The signs of the disease are thus given:—

"*Diagnosticks.*—1. Shuddering cold at first falling sicke. 2. Frequent vomitting, or at least reaching to vomitt. 3. Headache, diziness, and lightnes of the head. 4. Heat and thirstinesse. 5. Bleeding at the nose and sometymes at mouth, hemroids, and mensis. 6. Stiffnes in the necke or flanke. 7. Great inward heat and outward cold. 8. Carbuncles, buboes, blaines, blisters, spotts, rising on the body. 9. Distraction, staring frenzy, idle talk. 10. Drowsiness and sometymes continual watching. 11. A livid countenance, inclining to blacke, also a frowning countenance, etc., etc."

Here we have some of the unfavourable signs:—

"Some other more generall observations proving fatall this plague: Almost all that caught this disease with feare dyed with tokens in two or three days. About the beginning most men gott the disease with fadling, scorfetting, overheating themselves, and disorderly living. Tokens appeared not much till about the midle of June, and carbuncles not till the latter end of July, but were very rife in the fall about September and October, and seized most on the old people, adult cholerick and melancholy people, and generally on dry and leane bodyes. Children had none. If very hott weather followed a

showere of raine the disease increased much. If in the heate of the disease the winds blew very sharp and cold people dyed very quickly, many lying sicke but one day. Those that married in the heate of this disease (if they had not had the disease before) almost all fell into it in a weeke or a fortnight after it, both in city and in country, of which most dyed, especially the men."

The following observations on the spread of the disease are very interesting:—

"The winds blowing westward so long together from before Christmas until July, about seven months, was the cause the plague began first at the west end of the city, as at St. Giles, St. Martins, Westminster. Afterwards it gradually insinuated and crept downe Holborne and the Strand, and then into the city, and at last to the east end of the suburbs, soe that it was half a yeare at the west end of the city before the east end and Stepney was infected, which was about the middle of July. Southwark, being the south suburb, was infected almost as soon as the west end. The disease spread not altogether by contagion at first, nor began at only one place, and spread further and further as an eating spreading soare doth all over the body, but fell upon severall places of the city and suburbs like raine even at the first at St. Giles, St. Martin's, Chancery Lane, Southwark, Houndsditch, and some places within the city, as at Proctor's House."

The following passage gives Boghurst's view of the question of contagion:—

"Great doubting and disputing there is in the world whether the plague bee infectious or catching or not, because some think if it were infectious it would infect all, as the fire heates all it comes neare; but the plague leaves as many as it takes, thus are they gravelled at such arguments and cannot solve their doubts; and Van Helmont thinks all people catch it by feare, and generally everyone is apt to judge by his experience, for if they have beene in never soe little danger and yet have escaped without catching it they presently think the disease not infectious; and if anyone may draw his conclusion from this I have as much reason almost as any to think it is not infectious, having passed through a multitude of continual dangers cum summo vitæ periculo, being employed all day till six clocke at night, out of one house into another, dressing soares, and being alwaies in their breath and sweate without catching the disease of any, through God's protection, and soe did many nurses who were in the like danger; yet I count it to be the most subtile infectious disease of any, and that all catch it not by feare, neither (though this doth much as Helmont thinks) for their children, and confident people would not have the disease, but we see many of them also have it, and children especially most of any."

This treatise is not altogether unknown. I am glad to see that Dr. Creighton has since made good use of it in his valuable *History of Epidemics in Britain*, and has given longer extracts than I was able to do in the *Encyclopædia*. But I think it should be made known still more widely, and I take this opportunity of suggesting to this Society that to publish the whole or a great part of this treatise would be a valuable contribution to the history of epidemiology in England, and a public service well worthy of the Society. (It is No. 349, Sloane MSS.)

The Origin of Medical Statistics.

The seventeenth century, however, furnished more valuable contributions to medicine than its literature of the Plague. At this time, or at the close of the preceding century, begins a class of literature which, though humble in its origin, has developed into a valuable instrument for scientific research—I mean the science of medical statistics. These statistics, so far as England is concerned, began with what are called *The Bills of Mortality of the City of London*, which originated in a time of plague in 1592, and were first prepared for the information of the Government, being addressed by the Company of Parish Clerks to the Crown. After 1603 it became the custom to publish every week a list of the numbers of persons dying of the plague and of other diseases.* They were issued by the parish clerks in the several parishes of London, and the materials on which they were based were furnished, not by the medical profession, but by a class of old women who were specially employed to view the body and certify the cause of death in every house where a death had occurred. These records were anything but scientific, and the strange names assigned to fatal diseases, such as "Liver ground", "Rising of the lights", "Chrisomes", "Planet-struck", etc., seem very quaint to us now. Nevertheless, it is in the bills of mortality that we find the first mention of at least one disease which only later became known to the profession—viz., rickets. From the year 1634 we find deaths ascribed to this cause, though it was not till 1645 that Whistler printed his *Graduation-Thesis* at Leyden, and not till 1650 that the treatise of Glisson, generally regarded as the first on the subject (which I have here), was published.† We may therefore fairly say that the discovery of rickets was due, not to Glisson—though he first described the disease scientifically—or to any other physician, but to the old women and the parish clerks. The great importance of the bills of mortality, however, is that out of them have grown the invaluable statistics of disease which are now furnished by the Registrar-General's Department, and, in fact, the modern science of vital and medical statistics generally.‡

* London's Dreadful Visitation, or a Collection of the Bills of Mortality for this Present year. By the Company of Parish Clerks of London, etc. 1665.

† De Rachitide, sive the Rickets. By Francis Glisson, with the assistance of George Bate and Ahasuerus Regemorter. London, 1650.

‡ These records formed the basis of a book by Captain John Graunt, called "Natural and Political Observations on the Bills of Mortality", which was one

The New Fevers.

Looking again at the progress of epidemiology in the seventeenth century, we are struck with the fact that at this time various "new fevers" began to be described. I can show you several books relating to this subject by Greaves, by Whitmore,* and others. What these new fevers were is not always clear. Sometimes they look as if they were typhoid fever, sometimes typhus (though this latter is generally distinguished), and sometimes what has been called "epidemic malaria", while there were unmistakable epidemics of influenza also; but, as I am not speaking of the history of epidemics, I leave these questions untouched. Shortly after the disappearance of the Great Plague a period began in which these fevers were extremely common, both in this country and in Holland. We have a good account of one of the epidemics by Dr. Christopher Love Morley, an Englishman educated at Leyden, who describes, among others, his own case.† The impossibility of fitting in these diseases with the traditional description of tertians, quartans, and the like, undoubtedly gave great stimulus to the study of fevers, which is shown in the classical work of Morton,‡ in some chapters of Willis, and especially in the celebrated observations of Sydenham. These three great physicians may be grouped together as earnestly endeavouring to study epidemic diseases without any bias of scholastic interpretation, as if they were natural objects—as employing, in fact, what we may call the natural history method; although in other respects they were, especially Willis and Sydenham, very far apart. But as Sydenham was undoubtedly the most prominent representative of the school, and also the most influential, it will be enough if we confine our attention to him.

Sydenham, in approaching the subject of epidemics, was evidently inspired by the example of Hippocrates. Like

of the earliest, or quite the earliest, attempt at collecting vital statistics. The Third Edition, 1665, bears the *imprimatur* of the Royal Society. This was followed by the "Essays on Political Arithmetic' of Sir Wm. Petty (who is said to have collaborated in the former work); and the works of Petty are, I believe, generally admitted to have been the starting-point of the modern science which has lately been called "Demography". This fact was dwelt upon by some of the foreign visitors to the International Congress of Hygiene of London in 1891. I refer especially to Dr. Körösi of Budapest.

* Febris Anomala, or the New Disease. By H. W(hitmore). 1659.—Morbus Epidemicus Anni 1643, or the New Disease. Published by command. 4to. Oxford, 1643 [By Dr. Edward Greaves].

† De Morbo Epidemico, 1678-1679. By C. L. Morley. London, 1680.

‡ Morton: Pyretologia, sive de Morbis Universalibus Acutis. 1692.

the Father of Medicine, he gave copious records of the climatic and other conditions in connection with the prevalence of epidemics from 1661 to 1675. Unlike Hippocrates, he has not left detailed clinical reports of his patients. He attached little importance, as he himself says, to recording numerous cases. We cannot, however, but regret that this was his decision, for an adequate record of the course and symptoms of some of his individual cases of fever would have been extremely valuable, and would have enabled us to distinguish clearly—what is now sometimes difficult—the precise species of fever he was dealing with.* Sydenham's great principle in explaining epidemics was that of the *epidemic constitution* of the year. This was something independent of mere heat and cold, moisture and dryness, but due to a certain alteration of the air. While this epidemic constitution was the cause of the prevalence of one particular disease—say variola or plague—it also influenced other diseases besides the dominant one; so that when variola, for instance, was prevalent, other diseases partook of a variolous character. Notwithstanding, Sydenham never believed in one disease being changed into another. He insists very strongly on the *specific* character of diseases, which, he says, are like plants, having each its typical way of beginning, developing, and coming to an end. He himself did much towards discriminating different species of disease.

The theory of *epidemic constitution* has had many defenders, and the view that one dominant epidemic disease impresses some of its own character on other diseases has also been held in quite modern times—with regard, for instance, to diphtheria. Not very long ago the theory of a "change of type of disease" was actively discussed. I must confess to being very sceptical as to the reality of any such phenomena, but to discuss such a question now is evidently impossible. I would only throw out the hint that the existence and constancy of the laws of contagion were less clearly recognised in Sydenham's time than now, and the diagnosis of the different forms of fever was necessarily less minute, so that what was called the "epidemic constitution" might often be explained by the introduction into a particular place of some disease previously unknown there. Hirsch regards most of the epidemics of the "new fever" as due to the diffusion of an endemic malarial fever from its original seat to other

* T. Sydenham : Observationes Medicæ, circa Acutorum morborum curationem, 1676.

places where it was not habitually present. Whether this is an adequate explanation, and whether it explains the production of a new epidemic constitution in certain localities, I will not now inquire. I might remark also that the theory of epidemic constitution has quite failed to satisfy one test of a scientific law—namely, that of prediction; for no one has ever been able to foresee the occurrence of an epidemic constitution, and the only evidence for it is the actual production of an epidemic.

Epidemics and Weather.

Sydenham's observations again were imitated in those of Huxham, who for twenty-five years carried on at Plymouth most careful meteorological observations, combined with records of the prevalence or severity of diseases, which he thought to be influenced by atmospheric conditions. The same task was undertaken by Fothergill, by the younger Heberden, by Willan, and by Bateman in London down to the beginning of this century.* In reading these laborious and accurate observations one cannot help, I think, feeling a sense of disappointment. Even now it is exceedingly difficult to trace any definite relation between weather and epidemic diseases, except in so far as that cold or hot seasons naturally favour particular maladies of the respiratory or of the digestive systems respectively; but why special epidemics of cholera, of influenza, or of measles should come in one year more than another is a question on which, it must be confessed, meteorology has hitherto thrown little light.

Epidemiology in the Eighteenth Century.

At the beginning of the eighteenth century the study of epidemiology showed a distinct revival. Perhaps one indication of this was the publication by Freind of *Hippocrates on Epidemics*, to which I have already referred. But in 1720 the outbreak of plague in Marseilles and Southern France sent a panic through Europe, and led in England to the publication of a new literature on the subject. First came Mead's well-known pamphlet *On Pestilential Con-*

* John Fothergill : On the Weather and Diseases of London; Works, vol. i, 1783; 8vo.—William Heberden, Junior : On the Increase and Decrease of Diseases, particularly the Plague. London, 1801; 4to.—Robert Willan : Reports on the Diseases in London, particularly from 1796 to 1800. London 1801; 12mo.—Thomas Bateman : Reports on the Diseases of London and the State of the Weather, from 1804 to 1816. London, 1819; 8vo.

tagion,* written at the request of the Secretary of State, Craggs, in which he advocated strict quarantine regulations, afterwards authorised, but never actually carried out. Mead's work is, of course, not based on experience, and has no merit except the clearness of the style. It went through six editions before the end of the year. (I show you the first edition.) Naturally it called forth replies: among others one by Dr. John Pringle,† in which he entirely denied the efficacy of quarantines. Old tracts from the time of the Great Plague were looked up and reprinted‡; while Caius's Latin tract on the sweating sickness again saw the light, being edited probably by Jebb.§ But the excitement soon died away, and left no permanent mark on English medical literature.

The middle of the eighteenth century, which has been regarded as a period almost of stagnation in the progress of internal medicine, was nevertheless not without influence on epidemiology. It is true that little advance was made in the science of medicine, and few brilliant discoveries are associated with this period—at least until the last quarter of the century; but through the whole of the period, in which Mead, Heberden, Pringle, and Fothergill are among the most conspicuous names, great advance was made in the detailed knowledge of individual diseases. Now it is this knowledge of individual diseases which alone makes accurate diagnosis and discrimination possible. It is quite indispensable to a knowledge of epidemics, and, looking back over the whole period we have traversed, it is fair to say that a want of this detailed knowledge was the cause of the failure of all the earlier attempts, including those of Sydenham, at constructing a science of epidemics. Even in this century the old confusion between typhus fever, typhoid fever, and relapsing fever made it impossible to establish any coherent laws of the incidence and frequency of these diseases. It is only since they have been discriminated that we have been able to trace the influences which have made one or other of these fevers prevalent at any particular time or place. The lesson to be drawn is that epidemiology can only be founded on a basis of accurate clinical medicine.

The one most important event in the epidemiology of the

* Mead : Short Discourse concerning Pestilential Contagion. First edition London, 1720 ; 8vo.

† Inquiry into the Nature of the Plague. By J. Pringle. London, 1722 ; 12mo.

‡ Collection of Valuable and Scarce Pieces on the last Plague of 1665. London, 1721 ; 8vo.

§ See Note, page 7.

eighteenth century is beyond dispute Jenner's great discovery of vaccination; but the history and literature of this subject have been so often treated that I will here content myself with this brief mention and humble tribute. There are, however, two other branches in which the eighteenth century made important contributions to the science of epidemiology. The first is associated with the name of Sir John Pringle. This distinguished man was an army practitioner, and may be said to have been the first who systematically studied the medical aspect of army diseases as distinguished from the surgical. His classical work, *Observations on the Diseases of the Army*, published in 1761, was the starting-point of all modern improvements in military hygiene. I mention him with the greater pleasure because medical officers of the army have, by following in the footsteps of Pringle, made so many valuable contributions to the work of this Society. Sir Gilbert Blane rendered corresponding, and perhaps equal, services to the hygiene of the navy; but his medical observations were less important. The second branch of epidemiology, which began in the eighteenth century, was that of the study of foreign diseases. Considering the complexity of our relations with so many foreign countries, through the army, through the navy, through colonisation, travel, and so forth, it is not surprising that English medical writers should have contributed so largely to this branch of medicine, though the earliest, and for a long time the only, workers in this field were the Dutch physicians. Among the earliest British workers I would mention the names of James Lind, who wrote on the Remittent Fever of Bengal (Edinburgh, 1768), on other Diseases of Hot Climates, on Scurvy, and similar subjects, and Patrick Russell, whose observations on the plague and other diseases at Aleppo were published in 1791.

In the present century knowledge of such diseases has been greatly extended, and observations of this kind have formed a most valuable branch of the work of our Society. It is to those members of our profession who have gained experience either in military or civil practice in India that we owe a large part of these observations.

Epidemiology in Modern Times.

If I were to attempt to sketch, even briefly, the progress of epidemiological science within the present century, I should not only be recounting much that is known to

many of you much better than it is to myself, but I should also go far beyond the bounds of an address like the present. Looking at the relation of our branch of medicine to others, one cannot but be struck with the fact of the extremely wide field which the work of this Society covers. We touch clinical medicine on the one hand and statistical science on the other. We have close relations to geography and to history. We make use of the work of the traveller, the missionary, and even the sportsman, as well as that of the chemist and the physiologist. Part of our material is derived from the laboratory, and another part from external nature in the widest sense. Our progress is, moreover, intimately connected with the progress of numerous detailed branches of medical and of extra-medical science. It is no wonder, then, if the progress of epidemiology has been slow and interrupted; but still it does seem remarkable, and not altogether creditable, that the broad outline sketched by Hippocrates more than two thousand years ago should have waited so long to be filled up in proper colour and in adequate detail.

CONSIDERATIONS REGARDING THE NATURE OF INFECTION,

WITH SPECIAL REFERENCE TO

THE ACTION OF BACTERIAL POISONS.

By WILLIAM HUNTER, M.D., M.R.C.P.

(*Read: December 21st*, 1893.)

"It is as a branch of natural history, rather than of technical medicine, that the Society seeks to render the knowledge of epidemics and endemics more accurate and complete"—so runs the formula which describes the object for which this Society was originally founded. And foremost among the many subjects relating to epidemic and endemic diseases which in the opinion of its founders demanded investigation was the question as to the genesis of the great group of Idiopathic Fevers.

What progress has been made in that direction since that time, more especially during the last decade, is already well known to this Society, if only through the medium of many valuable papers included in its Transactions; and I have thought that in contributing a paper to the Transactions I could not do better than follow in the footsteps of my predecessors, and endeavour, however imperfectly, to discuss some of the problems relating to infectious disease in the light of the knowledge derived from recent investigations.

Among the many interesting papers relating to the nature of infection contributed before the Society during the past thirty years, two appear to me to be of special interest if only for their suggestiveness. One of these is a paper by Dr. Thorne Thorne "On the Origin of Infection", communicated in 1878, in which, by a process of careful reasoning and deduction from observations made during outbreaks of diphtheria, he formulated the important doctrine "of the possible occurrence of what may perhaps be looked upon as the progressive development of the property of infectiveness"—a doctrine which, although

receiving strong support from bacteriological investigations, cannot yet be regarded as definitely established.

The second of these is the earlier paper of Dr. (now Sir) B. W. Richardson "On the Theory of Zymosis" (1859), in which is discussed, in the light of the knowledge then available the probable *rôle* taken by ferments in the production of infective disease—a subject which the investigations of recent years have invested with an entirely new and fresh interest.

It is to this latter subject I purpose directing your attention in the present communication. I propose to consider in what respect our views regarding zymosis and ferment action, to which formerly such a great importance was attached, have been modified by the numerous investigations of recent years relating to the *rôle* of bacterial poisons and products in infective disease.

Retrospect.

Thirty years ago, when the earlier of these papers was written, bacteriology, as the important branch of pathological science it has since become, was practically undreamt of. The doctrine of *contagium vivum*, which had so long and pertinaciously been upheld on *a priori* grounds alone, had not received the additional support from accurate investigations which the work of later years has afforded it. It was still a "doctrine" about which opinions might, as indeed they did, differ very widely.

The nature of the "poison" admitted to be the immediate cause of infective disease was unknown. Opinion was still divided as to its being of *living* nature, as those following Henle maintained, or, on the other hand, of simple *chemical* nature as upheld by Liebig. According to Liebig, fermentation and other allied processes, of which infective disease was considered to be one, were purely chemical in their nature, and were brought about by the contact of bodies in a state of unstable equilibrium. In illustration of this view he adduced the case of oxalic acid brought into contact with oxamide, with resulting formation of ammonia and again oxalic acid. By adding fresh oxamide the process could be repeated indefinitely, so that, by means of a small quantity of oxalic acid to begin with, an almost indefinite amount of oxamide could be split up, fresh oxalic acid being formed each time. Alcoholic fermentation of sugar was considered to be an analogous process.

It was a view closely akin to this that Dr. Richardson

advocated in the paper referred to. According to him, "in the propagation of all communicable diseases there is one step in the process, which consists in the development of a substance—an albuminous matter—having the power of exciting chemical change or zymosis in the organism; and following on this, a second process consisting of a modification of the animal chemistry in such a way as to lead to the formation of acid and inorganic poisons upon the presence of which the symptoms of the disease depend." He cited as an illustration the case of cobra poison, a small quantity of which injected into the body induced the wildest possible disturbances. He concluded that the poison of small-pox and other similar diseases was probably of a similar character.

So far from admitting the doctrine of *contagium vivum*, he maintained that the virus of these diseases was "purely incidental to a modified chemistry in the organism—excrementitious in its character—as necessarily an excrete under the modified conditions induced by the disease as urea was a necessary excrete in health." It was the albuminous poison thus excreted that possessed the power of exciting zymosis in a person liable to such action.

The process underlying infection was in his view essentially chemical. So long as we continued in our researches to hold the opinion that in our study of the pathology of epidemics we were bound to seek out bodies of a vital form invisible even to the eye of the microscopist, so long were we, according to him, labouring after the improbable, if not the impossible.

The chief opponent of this *chemical* doctrine of the nature of contagium was Henle. As he pointed out, there was in truth but little basis for the assumption underlying it, that a dead chemical substance could multiply at the expense of another equally dead. The capability so characteristic of infective processes generally, of multiplying by assimilation of foreign material, was one that, on *a priori* grounds alone, could only belong to living organisms.

The analogy in favour of the chemical theory afforded by the case of alcoholic fermentation of sugar completely broke down when Pasteur conclusively showed that that process was a decomposition induced by a plant organism —the yeast organism. The remarkable extension and development this discovery has since received is well known. The importance of the *rôle* of micro-organisms in the causation of a large number of diseases is now established beyond all dispute.

And here it may be interesting to indicate very briefly the steps by which this knowledge has been arrived at.

The mere fact of the presence of organisms in diseased conditions by no means proved, of course, that they were the cause of these diseases. They might merely be coincident phenomena—both alike the result of some deeper unknown chemical or physical disturbance. The true relationship of the organisms to disease could only be established by means of experiment. A most important step in advance was made when it was thus shown that the same disease could be induced by inoculation of these organisms even after their removal and cultivation outside the animal organisms for many generations.

Even then it had still to be shown that this result was due to the action of the micro-organisms, and not to the presence of some other agent of non-bacterial nature—possibly of some poison. Infective disease, according to this line of argument—the last rampart of the upholders of the chemical doctrine—might be due, not to micro-organisms, but to some chemical poison which somehow or other clung to them even after successive cultivations outside the body.

As partly meeting this objection to the doctrine of the *living*, as distinguished from the *chemical*, nature of contagium, Davaine, a French observer, showed that virulent fluids retained their power of inducing disease even after dilution to a degree that must have deprived them of any simple poisonous action, the blood of anthrax being still active after dilution a millionfold. Such an argument was, however, not in itself conclusive. For ordinary ferments can suffer very great dilution without losing their power. Thus the glycerine extract of jequirity seeds contains a ferment capable of acting even when the dose is no larger than $\frac{1}{100000}$ of a gramme of the seed.

Koch came nearest of all to prove the living nature of contagium when he showed that the blood of anthrax—in whatever condition it might be, dry or moist, fresh or after years, dilute or concentrated—was always capable of infecting *only* so long as the anthrax organism remained capable of again developing. In other words, the power of inducing disease in the case of anthrax is in some way connected with the *life* and *development* of the anthrax bacilli, not simply to some chemical poison associated with them.

For a large number of infective diseases the living parasitic nature of contagium is now established beyond all dispute. It is no longer a *doctrine*, it is a fact, as

definitely established as, unfortunately, but few facts in pathology can be.

It is established, moreover, that poisons play an important part in infective disease. The term *poison* in this relation has, however, now a different significance from that formerly attaching to it. In the sense employed by Dr. Richardson in the paper already cited, the poison was in itself the *agent provocateur* of the disease. The albuminous body thrown off from the body during disease was capable, on transmission, of setting up the selfsame disease.

It has now a more limited significance. When we speak of poisons in this relation, we refer to the substances of albuminous or alkaloidal nature formed by the action of pathogenic organisms constituting the weapons by which these organisms produce their disease effects.

Many of these bacterial products are only potential poisons. As regards the bacteria themselves, they constitute useful weapons by which the bacteria obtain their necessary nourishment, or protect themselves while undergoing development. Thus, as will presently be seen, many organisms form ferments, capable of dissolving gelatine, or converting starch into sugar, and the tetanus bacillus when freed from the poison which it excretes is a comparatively harmless organism, and readily falls a prey when introduced into the body.

Let me, then, direct your attention very briefly to some of the chief characters of these weapons, and the purposes to which they serve in the life history of the organisms which form them.

Character of Bacterial Poisons.

They may be divided into two large groups—those of *albuminous* and those of *non-albuminous* nature. The latter are for the most part nitrogenous bases, and belong, therefore, to the group of *alkaloids*.

Of the intimate chemical constitution of these poisons we know as yet but little. This arises from two circumstances: *First*, as often as not, the more poisonous the body the more unstable it is; and it is thus easily destroyed in the process of separation and examination. *Secondly*, the quantity formed is in all cases exceedingly small.

It simplifies somewhat our conceptions of these bodies if, instead of looking upon them in their purely chemical (and still very obscure) relations, we take a wider view of their character.

As in physiology the unit we keep before our eyes is the *cell*, so in this branch of study the unit to be kept before us is the *albuminous molecule*. As the cell undergoes particular modifications of structure with corresponding variations in function in disease, so also the albuminous molecule under the influence of disease factors (and prominent amongst these in this relation is bacterial action) is liable to rearrangements of its constituent parts with corresponding alterations in its characters.

Moreover, just as in the cell great disturbance of function may depend upon changes too slight to be *microscopically* recognizable—*e.g.*, the change underlying epilepsy or diabetes—so in the case of the albumen molecule, rearrangement of its parts not *chemically* recognizable may carry with it great changes in the character of this molecule, converting what was formerly a harmless and inactive substance into a powerful poison.

Thus the majority of albuminous poisons which have been so far isolated belong to the group of *albumoses*, and differ in no way chemically from the ordinary albumoses of digestion. This has been conclusively shown for the poison of diphtheria, tetanus, and anthrax (Sidney Martin). Nevertheless, the action of all these albumoses is specifically distinct.

Conditions influencing Bacterial Life.—The behaviour of bacteria under different circumstances is regulated mainly by the one prime consideration of obtaining a sufficient supply of the various elements necessary for building them up (carbon, nitrogen, oxygen, hydrogen, and mineral substances) in the easiest possible way.

In obtaining this prime object there are many conditions by which their activity is materially influenced, such as *concentration* and *reaction* of the surrounding medium, *atmospheric pressure, light, electricity, mechanical movement*, and the like; one of the most important being *temperature*, while another, belonging to a somewhat different category, is *association with other micro-organisms*.

Their primary necessity is to get a supply of their constituent elements in the easiest way possible.

Their *nitrogen* is taken up, not as free nitrogen, but preferably in the form of NH_2 group, more rarely in the form of NH group; and if necessary they can obtain it from the ammonium salts, such as tartrate of ammonia. But by far the best material for their purpose is albumen, especially the easily diffusible peptones. It is to the conversion of albumen into the more easily assimilable peptones

that their efforts are first directed; and it is at this stage that in the case of the pathogenic bacteria poisonous albumoses may be formed as an intermediate product.

Their *carbon* they derive from sugar and bodies of similar nature, and from glycerine; also from fatty acids, citrates and tartrates, malic, lactic, and acetic acids; also from alcohol (ethyl group).

It is as regards their need for *oxygen* that the most striking differences prevail amongst bacteria. In obtaining this—at all costs—harmless bacteria may frequently give rise to products of poisonous nature. I found, for the ordinary bacteria of putrefaction, that if oxygen were freely supplied, no poisonous bodies were formed; while, if oxygen were entirely excluded from the putrefying mixture, large quantities of ptomaines (cadaverin and putrescin) and other by-products (indol, skatol, etc.) were formed.

Fermentation thus plays an important part in the formation of many poisons. It is doubtful, however, whether it is the chief part. Bacteria act not only directly, by exciting *fermentation* in albuminous material, but also indirectly, by means of *ferments* and *ferment action.*

Ferments.

The power of forming ferments is one possessed in varying degree by all cells alike. And among the many changes which may be impressed on the albuminous molecule through the agency of living protoplasm, no one is more interesting than this one.

I need hardly recall to you the general characters of the class of bodies we call ferments. You are familiar with them, in the case of the special ferments formed by the gastric, salivary, and pancreatic glands—capable of converting starch or cane-sugar into the highly diffusible glucose (diastatic ferments), or the large and indiffusible albumen molecule into peptones (proteolytic ferments).

The power of forming similar ferments is possessed by a number of bacteria; and in the life history of the bacterium it may become a power of importance, enabling it to act at a distance, and supplying it with food material in an assimilable form.

Gelatine-dissolving Ferments.—Thus a large number of organisms possess the power of liquefying gelatine, and it has been shown conclusively by Bitter, Fermi, and others, that this is due to the action of ferments they produce. Bitter's experiments were of the following nature:

He made a culture of gelatine of Koch's cholera vibrio, and then sterilized it up to 60° C. for six days. Six drops of the sterilized culture were then poured into a series of seven tubes containing solid nutrient gelatine, which were then kept at a temperature of 37° C. for five days. At the end of this time, on being taken out and cooled down to a temperature of 0° C., it was found that a portion of each tube was partially liquefied. Since the tubes were sterile, the liquefaction must have been occasioned by the presence of a body of ferment nature, and such a body he succeeded in obtaining from the liquefied material by precipitation with alcohol—soluble in water and in glycerine, precipitable by alcohol, destroyed by boiling. When dried it had the form of yellowish amorphous powder, resembling pepsin or trypsin.

Influence of Heat.—One of the most interesting points with regard to such ferments is the influence of heat upon them. The ferments of different organisms differ very considerably as regards their power of resistance to heat. Thus, none of them are destroyed by a temperature of 50° C., while none of them can withstand a temperature of 70° C. Thus, as Claudio Fermi, who has specially investigated the subject, has shown, while the ferment of *M. prodigiosus* is killed by a temperature of 55° C., that of *bacillus pyocyaneus* by 60° C., that of anthrax is only weakened by a T. of 65° C., and that of Finkler and Prior's bacillus proved the most resistant of all, acting energetically on gelatine even after being heated up to 65° C.

If we compare these temperatures with those by which pepsin, trypsin, or papain are affected, a striking similarity appears. The action of pepsin is stopped by a T. between 65° and 70° C., of trypsin by a T. of 60° C., and of papain by a T. of 65° to 70° C.

Their power of resistance to dry heat is much greater; the ferment of Finkler and Prior bacillus being unaffected by a T. of 140° C. maintained for ten minutes, while trypsin and papain are both active after heating to 120° C.

This power of forming a gelatine-dissolving ferment is possessed by a large number of bacteria. Out of 140 varieties investigated by Fermi, no fewer than forty were found to possess this power.

A much smaller number produce a ferment capable of dissolving fibrin; only five out of the above number possessing this power.

It is one, probably, of considerable importance to the pathogenic organisms possessing it. Organisms most active

in producing ferments will usually be most active in their growth, as they are thereby enabled to obtain a more abundant supply of nourishment.

Diastatic Ferments.—A large number of bacteria possess, further, the power of producing ferments capable of converting starch into sugar, some in higher, others in less degree.

These may be formed even under circumstances when no starch is present. Thus Fermi found that diastatic ferments were formed in gelatine, nutrient broth, and blood serum cultures by the bacillus of anthrax, cholera, and Finkler and Prior, but not by *M. prodigiosus* or *B. pyocyaneus.*

Influence of Temperature.—As in the case of the gelatine-dissolving ferments, so with the diastatic, a T. of 70° C. for an hour suffices to destroy them all, and most of them are weakened by a T. of 55° to 60° C. In a dry condition, on the other hand, they all resist a T. of 120° to 140° C. for fifteen minutes.

The question has been raised whether these two classes of ferments may not be one and the same. Some have maintained that they are (Baranetzky and Wigand), while others (Wortmann and Fermi) that they are not.

The following considerations adduced by Fermi seem to justify the conclusion at which he arrives—that the two kinds of ferments are totally distinct:—

1. The ferment of the cholera bacillus when heated to 60° C. still acts on gelatine, but no longer on starch.

2. The ferment of Finkler and Prior bacillus at 40° C. has a diastatic action, but none on gelatine.

3. Bacteria capable of producing both gelatine-dissolving and diastatic ferments produce only the former when grown in egg albumen, while only the latter when grown on starch.

4. *M. prodigiosus* and *B. pyocyaneus* produce only gelatine-dissolving ferments; while *B. tetragenus, B. coli,* and others, produce only diastatic ferments.

What is it that induces bacteria to form ferments?

In the case of carnivorous plants, placing some albuminous material on the leaf suffices to induce a secretion of a peptic ferment; whereas the irritation produced by fragments of glass causes the secretion of an acid, but not of a peptic fluid.

Ferment production, then, it may be assumed, is not the result of any mere mechanical irritation of the bacteria by the substances with which they are brought in contact.

Neither insoluble nor unpeptonized albumen can them-

selves bring about the formation of gelatine-dissolving ferments.

If this were so, we might expect that bacteria grown on peptones would not produce ferments. Nevertheless, they do. On the other hand, no such ferments are formed when bacteria are grown on *nutrient salts*.

It is clear, then, for the great majority of bacteria, that they only produce ferments when albuminous material is present.

The formation of ferments by bacteria is, then, a function exercised by them in response, in great part, to their need; being, however, called forth by special circumstances. The favourable circumstances are, for the gelatine-dissolving ferments, the presence of albuminous material, and for the diastatic, the presence of sugar-forming substances.

The Rôle of Ferments in Disease.

To what extent does this power of forming ferments influence the pathogenic properties of organisms? Probably, in the case of these simple ferments, only to a limited extent, but none the less interesting, as I may illustrate by reference to the case of the differences in action of streptococcus and staphylococcus pyogenes.

Both these organisms are pyogenic, both excite local inflammation with pus formation. But there is this difference in their action, that while the streptococci tend rather to produce diffuse inflammation without softening of the erysipelatous type, the staphylococci tend rather to produce localised inflammation of the nature of boils, pustules, carbuncles, abscesses, etc. Now, both organisms produce ferments capable of dissolving meat and albumen, but the power of the streptococci in this respect is much inferior to that possessed by the staphylococcus. The streptococcus produces no gelatine-dissolving ferment, while the staphylococcus does.

The difference in the character of the inflammation induced by the two organisms above noted is doubtless then related to their relative powers of inducing softening of gelatine and albuminous tissues.

A further difference between the action of these two organisms is that the suppuration induced by streptococci is much more liable to lead to general infection, and to be followed by metastatic deposits in distant organs, than that produced by staphylococcus. Indeed, in the case of the latter no such liability exists.

Now the production of a general infection from a local one may take place in two ways, either through the lymphatics or by embolism through the blood stream.

The peculiar spreading character of the inflammation induced by streptococcus—as, for example, in erysipelas—indicates that the lymphatic spaces are kept open, while, as we have seen, with staphylococcus the tendency is for the inflammation to be localised. Possibly this difference in the action of the two, as regards their liability to be followed by general infection, is related to their relative powers of forming ferments capable of dissolving the tissues.

The power of the streptococci in this respect is feeble, and in consequence lymphatics are left open for their extension along them. In the case of the staphylococci, on the other hand, softening early occurs; the lymphatics are blocked up, and from the very first the inflammation takes on a more localised character.

Another difference in the action of the two organisms may be noted, probably also related to this difference in the relative powers of forming gelatine-dissolving ferments —one noticeable when the inflammation they excite is superficial—namely, that while the inflammation excited by streptococci tends to lead to the formation of diphtheritic membranes, that excited by staphylococcus does not.

Diphtheric membrane is dead material, undissolved. The power possessed by staphylococci of producing ferments capable of liquefying the gelatine of the tissues is such that the inflammation it excites is always accompanied by softening, whereas in the case of the streptococci, with their feebler powers, this is not the case.

The membrane formation accompanying the diphtherial inflammation of the throat is in all probability, then, in great part due to the streptococci—so invariably found present.

It would seem, then, that the pathogenic properties of organisms may be materially influenced by such comparatively slight factors as their relative powers of producing ferments of the simplest possible kind.

To what extent are they capable of forming ferments possessing more powerful and more specific actions?

In the example cited above, the action of the ferment was not specific; it was the same in both cases, only differing in degree.

To what extent may it also differ in kind as well as in degree? To what extent, that is to say, can an organism

produce not only a substance possessing a specific poisonous action—of that we have many examples—but one of ferment nature capable of exciting, without itself being immediately destroyed, changes of a definite specific character in the proteid molecule of the tissues?

Is it possible, in other words, that certain micro-organisms can produce a body possessing specific ferment powers—capable of initiating, at a distance from their seat of production, definite chemical changes in the tissues, and continuing to do so for a certain length of time?

Take, for example, the case of a localised infection like diphtheria, liable to be followed at a considerable interval of time after apparent recovery by well-marked changes affecting the nerves, indicated clinically by paralysis, and pathologically, as Sidney Martin has recently shown, by localised degenerations occurring in the course of the affected nerves.

To what are we to ascribe these changes? To the cumulative action of a poison produced at the time remaining within the body, or to the formation of fresh poison from time to time under the influence of some agent which the original infection has left in the body?

The question I have raised appears to me to be of special interest, none the less so that as yet no definite answer can be given to it.

You will see what it means. The older view, as we have seen, was that infective disease could be excited by the entrance of a chemical virus into the body, thrown off from a body previously affected; that this chemical virus, in virtue of its instability, could excite definite chemical change.

The investigations of bacteriology have shown that the initial agent is not of chemical, but of living nature; that it is not dead material that leads to the formation of definite chemical products, but living organisms.

The considerations I have just brought forward present us with the possibility of an alternative and, to some extent, intermediate view, namely, that the *contagium vivum* may not only act directly by producing its specific poisons, but that it may possibly act also indirectly by giving off a ferment, which in turn is capable of transforming the albumen of the tissues into definite specific poisons, probably mainly, if not solely, of albuminous nature.

Are there any facts to support such a contention, which appears at first blush to be in some respects a partial

return to the older and apparently no longer tenable view. The only facts I know adducible are those connected with the case of diphtheria, as described by Sidney Martin.

This disease has now been conclusively proved to be due to the action of a specific bacillus, first described by Klebs and Loeffler. With pure culture, as Loeffler shows, it is possible to reproduce all the characteristic features of the disease, including membrane formation, and the subsequent paralysis.

From such cultures, Roux and Yersin succeeded (1888) in isolating a poison possessing all the actions of the culture fluid itself. And Sidney Martin has more recently, and in fuller and more complete manner, succeeded in isolating and investigating the poisons formed by the bacillus. He finds them to be of two kinds—the chief one being of albumose nature, and the other being an organic acid.

The poison isolated by Roux and Yersin was likewise of albuminous nature; but the prominent fact they noted in connection with it was that its activity was much diminished by heating to a T. of 58° C., especially if light and air were admitted free entrance.

This behaviour was so peculiar, and so characteristic of ferments in general, that they very naturally concluded the poison to be of this nature.

I do not gather from Martin's work that he has met with or investigated any similar body; but if I understand aright, he accepts Roux and Yersin's view of its existence and of its ferment nature; and he considers that it probably plays an important part in the formation of the albumose poisons which he himself describes.

The probable course of events, according to him, is that the bacillus localised to the seat of infection produces a ferment capable of transforming the albumen of the tissues into poisonous albumoses: that this ferment, however, not only acts locally, but passes into the body, is stored up for a time in the spleen, and continues to exert its action in forming poisons. In short, so long as the ferment is present in the spleen, that organ forms not only a storehouse, but a manufactory for new poisonous material.

Such a view, as I have said, is an important departure from the position hitherto taken up with regard to the mode of action of bacteria.

If it prove to be a correct interpretation of the facts, it would involve, to a certain extent, a revival of the older view that definite chemical change could be induced by a

body of non-living nature; for it is precisely such a change that the ferment produces in the spleen in the case cited. No organisms are present, and it is acting at a distance, and not only so, but it is producing poisons for a certain length of time even after the original infection has been got rid of.

I confess, for my own part, I shall watch with some special degree of interest the further developments which will take place in this relation. Up to the present it is only an interpretation of carefully studied and observed facts, which, after all, may admit of another and simpler one.

Before accepting it as final I should wish to feel assured that the phenomena of the delayed paralysis could not be fully explained as being due to the slow and cumulative action of the poison formed at the seat of infection, and stored up for a time within the body.

In any case, if such a ferment were present in the spleen, as is assumed in the foregoing view, it might be possible to isolate it.

Be that as it may, I hope I have succeeded in indicating to you the importance of the study of ferment action in relation to the processes of infection, and how important ferments may possibly be as agents in the production of disease.

ALBUMOSES.

I pass now from that subject to consider another class of bacterial products, of great, possibly even greater importance in disease, and not remotely related to the bodies we have just been studying.

Returning to the unit we selected for study—the proteid molecule—the poisonous albumoses represent a very slight alteration in the original molecule so far as our present methods of chemical investigations of these bodies enables us to ascertain.

In fact, just as in the case of the cell, our microscopic methods may fail to reveal the slightest structural alteration where there is the greatest disturbance of function, so in the case of these albumoses we are unable to detect in what respect they differ chemically from ordinary simple albumoses of digestion, and yet they may have the most poisonous action. So far as these chemical properties can be determined, they are identical with the albumoses of digestion.

It is only within the last few years that the existence and importance of these bodies as products of bacterial activity and factors in the production of disease have been fully demonstrated; and they have now been shown to have an importance second to none—not even to the poisonous alkaloidal bodies (ptomaines), which were much earlier recognised.

It has now been shown for a large number of organisms —and more particularly for those possessing the most powerful pathogenic action—that their poisonous action on the body is to a large extent due to the formation of poisons of albumose nature, and to no worker in this field are we more indebted than to Sidney Martin.

This has been proved for the poison of diphtheria (Martin), tetanus (Martin and Brieger), anthrax (Haukin, Martin), cholera (Hüppe and Scholl, and Gruber), tuberculosis (Crookshank and Herroun, Hunter).

A special difficulty exists, however, with regard to determining the true nature of these substances, or the amount in which they are formed, inasmuch as digestive albumose material is so commonly present in the culture fluid in which the organisms are grown, and chemically are indistinguishable from those of poisonous nature. It is not clear even to what extent the poisonous activity which they possess may not be due to substances of simpler nature in more or less intimate union with the albumose material.

The explanation which appears to be at once the simplest and the most probable is, that the bodies are really of an albumose nature; and that they derive their active properties from the special arrangements of the parts of the molecule. For a feature common to a number—although not to all bodies of this class—is that they are very sensitive to outside influences, and very quickly lose all their activity.

Thus it has been shown for the poison of tetanus by Kitasato that mere exposure to ordinary daylight sensibly weakens it, while exposure to direct sunlight rapidly renders it inert.

And so with regard to heat. For the larger number of them, although not for all, it holds true that even in the moist condition their poisonous property is sensibly affected by exposure for a length of time to any temperature over 80° C., and not one of them can resist a temperature for any length of time in this dry condition.

In some cases, indeed, although this applies not so much

to albumoses as to albuminous bodies generally possessing active properties—for example, the proteids of blood serum —the temperature by which they are affected is lower, recalling that at which, as we have seen, the activity of ferments is affected, viz., 55° and 60°.

But, as I have said, there are great differences in the behaviour of bodies of this nature in this respect, some being unaffected even by boiling for many hours. Of this latter kind are the albumose substances derived from the bodies of bacteria, the so-called proteins of Buchner. And this fact has led to the conclusion that there are in reality two classes of albuminous poisons derivable from bacterial action, one class which I may for convenience term *extra-bacterial*, formed by the action of the bacteria on the albumen of the tissues, and never really constituting a part of its protoplasm, and the other what I may term the *intra-bacterial*, being derived from the bodies of the bacteria themselves.

The former may be looked upon as *products* of the activity of bacteria, the latter as constituent parts of the bacteria themselves. It is the latter class that proves the most resistant to the action of heat, and presumably, therefore, are the more stable of the two.

The Action of Albuminous Poisons.—Any detailed account of this would involve a consideration of many of the characteristic symptoms of the different diseases in which albumoses are found.

I will not trouble to do this, but will content myself with pointing out two or three of what seem to me the chief features of their poisonous action.

And the first I would note is their *chemotactic power*—the power, namely, of influencing in a special manner the movements of leucocytes either in the way of attracting or repelling them.

Knowing what we now do regarding the importance of leucocytic action in the combat of the body against micro-organismal invasion, this property of albumose poisons is obviously one of the utmost importance both to the body and the attacking organism; on it may hang in great measure the ultimate decision as to which is to be the victor.

Let me illustrate this by reference to the case of the tetanus bacillus, than which no more active and virulent organism has yet been discovered, and the poison of which is active to a degree absolutely without parallel in the case of any, even our most powerful drugs.

It has been shown for this bacillus by a French observer —Vaillard—that if before injection the bacilli be washed, so as to remove so far as possible the poison adhering to them, relatively large numbers of the bacilli may be inoculated without occasioning the disease.

The injection is followed by an inroad of leucocytes to the point of inoculation, and the issue of the conflict which then ensues is favourable to the body; the bacilli have been attacked, so to speak, before they had got acclimatised to their surroundings.

The effect of injecting them without previous removal of their poisons was very different. Much smaller doses then proved fatal, and no leucocytic invasion at the point of inoculation took place. The issue in this case, then, seemed to be wholly determined by the presence or absence of the bacterial poison.

In its presence the leucocytes were repelled, and time given for the bacilli to accustom themselves to their new surroundings, and to form more poison; while, in their absence, the bacilli were for a time without means of defence, and fell a comparatively easy prey to the surrounding leucocytes.

The foregoing is an example in which the chemotactic power of the poison falls in favour of the micro-organism. In most cases, however, fortunately for the body, the result is the other way about. Either in the first instance, or if not, then later, the presence of the organisms with their products attracts large numbers of leucocytes, and the issue is the one we see so typically exemplified in the case of a small local pustule or boil—definite restriction of the invasion after death of a varying number of leucocytes.

To what extent these albumoses have special *pyrogenic* properties there is in my opinion room for considerable difference of opinion. That in large doses they can and do excite high fever in many cases there is no doubt. But from my own study of the albumoses of tuberculosis, no less than from other considerations, I am disposed to think that as pyrogenic agents they cannot specially be regarded.

Crookshank and Herroun found that the albumose they obtained from cultures of the tubercle bacillus tended in large doses to cause a fall of temperature, and in my own observations with albumoses I obtained from tuberculia I constantly had occasion to observe that the injection was followed by a fall in temperature. In large doses they,

of course, caused a rise of temperature, but this was probably related in great part to the changes set up in the diseased organs.

And similarly with tetanus and diphtheria, both of them diseases, as Sidney Martin has shown, attended by the formation and presence of albumoses in the blood and organs for very considerable periods of time, and in the case of diphtheria at least for some time after all fever has ceased.

And this leads me to the third feature of the action of albumose poisons, which I desire here to note, namely, the *relative durability* of their action, especially as compared with the alkaloidal group of poisons.

The power of persisting within the body for a considerable length of time—as exemplified in the case of diphtheria—is one of considerable interest, and not merely in relation to the production of symptoms of disease, but also and still more in relation to the production of other phenomena connected with infective disease, namely, the phenomena of immunity.

Whatever be the nature of that process, or the changes, chemical or otherwise, underlying it, one thing is clear, that the influence exercised by the previous attack on the body must be a profound one, since it is in many cases so lasting. Considering how short the duration of the original attack which ensures immunity may be, it is obviously a consideration of importance if during the short period substances be produced capable of acting on the tissues for days, it may even be for weeks, afterwards. I cannot conceive of any alkaloidal substance having a prolonged action of this kind—at any rate, it is much more difficult to conceive of it doing so than it is of an albuminous body.

For—and this leads me to the last point I will note with regard to the action of albumoses—the action of these bodies seems in many cases to be more akin to that of a ferment, than to that of a simple poison. That is, the poisons seem to transmit some influence to one particle which in turn is transmitted to another, and so on throughout the entire mass. Either this, or it itself, can excite such change by contact with the various tissues, without itself being destroyed. In either case its action is akin to that of a ferment rather than to that of a poison.

Consider, for example, how quickly an animal can be rendered completely immune to even the largest doses of a poison so strong as that of tetanus is, and how widespread

and rapid must have been the chemical changes induced, that the injection of a few drops of its blood serum is capable of conferring equal immunity on another.

What a different conception this gives us of the power of cells—for it is ultimately to cellular action that everything must be referred back—and of the power they possess of modifying each other's character from any we formerly possessed.

If regard be had to the blood alone, in what a different aspect does the leucocyte now present itself as compared with formerly, and how widely different our conceptions of the properties and potential powers of the serum and plasma of the blood.

THE AERIAL CONVECTION OF SMALL-POX FROM HOSPITALS.

By JOHN C. McVAIL, M.D., F.R.S.E.

(*Read: January 17th*, 1894.)

In opening the discussion on the possible influence of small-pox hospitals in aerially conveying the disease to surrounding population, let me state *in limine* that my purpose is rather to review existing knowledge than to adduce new facts, unless, indeed, some facts to which I wish to draw attention are so very old as to be entirely new to any of the members of the Epidemiological Society. For it is a trite saying that history repeats itself, and even in regard to the discussion of this subject the saying holds true.

A century ago, the celebrated Dr. Haygarth of Chester, and Dr. Waterhouse, Professor of Physic in the University of Cambridge in New England, had a lengthened controversy on this very question, and some of the points then raised are not without interest to us in the present day. Haygarth was the author of *A Plan to Exterminate the Small-pox*, the plan consisting of small-pox inoculation plus isolation. But the isolation he advocated was not necessarily by means of hospitals. He held that the disease could not spread aerially from one room to another in the same house, and that as to transmission through the open air, in moderate cases, a distance of a foot and a half might be looked on as the limit, and that the infection of fevers was "confined to a much narrower sphere"—much narrower, that is to say, than a radius of 18 inches. In support of his views he cited experiments (which, he said, "must strike every reader of sound sense with irresistible conviction") in which *moist* small-pox matter had failed at this distance, entirely forgetting that only dry matter might be expected to be disengaged from its source and carried atmospherically. At the same time Haygarth hotly opposed the thesis of a Dr. Paulet, who held that variola was not to be transmitted excepting by actual contact. In promulgating his own opinions, he therefore carefully steered his plan between Scylla and Charybdis. If, on the one hand, he agreed

with Paulet, isolation, as defined by Haygarth, was needless; if, on the other hand, aerial transmission were possible beyond the limits of an apartment or a house, this system of isolation was useless. As to clothing, he asserted that "variolous miasms never adhere to clothes so as to communicate infection", and he challenged any man to prove the contrary. Here, however, it is important to notice that by "miasms" he did not include serum, pus, or scabs adhering to clothing. He argued that the poison of small-pox when conveyed at all by the atmosphere is not particulate, but is dissolved equally all through it. And so he sent out to various correspondents a series of questions, of which one referred to transmission by clothing, and another was as follows: "Did you ever know the small-pox conveyed out of one chamber into another by a person who certainly did not carry any variolous serum, pus, or scab on their clothes, hands, or feet, etc.?" Among the correspondents to whom these queries were sent was Professor Waterhouse. Now, Waterhouse also had a plan of dealing with small-pox, but it differed widely from Haygarth's. Waterhouse was by no means satisfied with isolation in a room or a dwelling. On the contrary, he had his cases transported by water to an island half a mile from the shore, which again was two to three miles distant from the principal town. Elaborate precautions were also taken as to prevention of personal transmission of the disease by the attending physicians. Waterhouse, however, thought that the island, as such, was unnecessary, provided there was used in its stead a hospital, situated a considerable distance from a public road, or on a point of land jutting out into the sea. Such was the New-England method of isolation, and Waterhouse at once joined issue with Haygarth, both as to clothing and as to the theory that small-pox was not aerially conveyable beyond the patient's chamber. Regarding aerial convection, here is his statement: "I would observe that that physician who believed the variolous infection to extend *thirty miles*, and he who supposed it to extend not *thirty yards*, seem, according to our observations, to be equally out of the way. Charleston is separated from Boston by a deep river, *fifteen hundred feet* wide. Close by the water-side in Boston was a house or two infected with the small-pox, in one of those dull, foggy days (such as commonly produces a dark day in London), when there was scarcely wind enough to blow the smoke from the tops of the chimneys; yet what wind was stirring wafted it across the river to Charleston. In its direction on Charles-

ton side was a shipyard, and ten or a dozen carpenters at work, all liable to the disease. They all took the small-pox excepting two, and the eruptions appeared at the usual time from that day.

"We have the clearest proof of the small-pox being communicated to the distance of several hundred roods, viz., from the hospital at West Boston to several families in the neighbourhood. The atmosphere was for many days loaded with aqueous vapours, and the little motion it had was towards the houses where the small-pox made its appearance. The guard (for the hospital was military) which was continually kept prevented all communication." In a subsequent letter, Waterhouse states as to the cases which produced the cross-river infection, that the dissemination occurred "when several houses were highly infected". As to the exact distance, he adds that, since he had first written to Haygarth, a bridge had been built across the river, and the previous statement confirmed by measurement. It would, therefore, appear that there was no bridge when the infection was alleged to have occurred. In trying to reconcile Haygarth's facts and opinions with his own, Waterhouse argues for the variability of small-pox infectivity. In America he had observed "the difference in the virulency of small-pox observed at the different periods when epidemic here", and he urged that there may be differences in climatic conditions, differences in the atmosphere, and differences in individual susceptibility as between one time and another, and one nation and another.

In Haygarth's reply he tells Waterhouse that it was only the New England dread of small-pox that made them hurry patients away to pest-houses, and that in this way they were prevented from ascertaining the truth of the view that small-pox could not be aerially conveyed from one room to another in the same house; that they had plenty of fogs in England, but no record of their spreading small-pox; and as to the disease being carried six miles by means of a wig (as had been alleged by Waterhouse), he maintains that, according to no known chemical principle, could a wig attract miasms from the air and again restore them to it; and that if, indeed, a wig kept on giving forth small-pox virus for six miles it was capable of infecting 15,840 persons standing two feet apart in a line six miles long. Similarly, as to the cross-river case, if small-pox *could* be aerially carried for 1,500 feet, then in England "every person susceptible of the distemper *would* (the italics are mine) inevitably be attacked in a few weeks".

As to the poison being carried several hundred roods from a hospital, he asked Waterhouse to consider how extreme would be the dilution at this distance, seeing "that the variolous poison is diluted 500 times more at the distance of 45 feet than in the patient's chamber". Then Haygarth goes on to argue that negative evidence is "incomparably stronger" than affirmative evidence. He calculates that, "in any place visited by small-pox, if *one* has escaped the distemper, it is 19 to 1 he has not been exposed to the infection"; and that "if three in a family have escaped, the probability that they were not all three exposed is 8,000 to 1."* Therefore, he holds that the escape of persons within a specified distance from a source of infection is almost infinitely strong evidence that the infection could not have been carried so far from its source. And now, in the history of this controversy, we come to the remarkable fact that Waterhouse in reply expresses agreement with this doctrine of Haygarth's as to the value of negative evidence.† Though he continued to defend the various examples he had given, yet in yielding this point he yielded his whole case, and it is not surprising that Haygarth, just at the end of his book, is able to relate that Waterhouse, having subsequently had experience of a small-pox epidemic in Boston, had arrived by negative evidence at the conclusion that the virus was not atmospherically conveyable, as he had originally believed. Unfortunately, this letter of Waterhouse's arrived too late for publication by Haygarth, so that we have no details as to the negative evidence in question. It is, however, an interesting indication of the nature of the proof that Haygarth relates (from Waterhouse's letter) how, in this particular epidemic, a great number of failures occurred in conveying the disease by inoculation, even after four or five successive attempts, and how very few were attacked in the ordinary way, "although many were in the same room with those

* This calculation starts with the opinion (based on facts adduced by various writers) that about 5 per cent. of all persons born are insusceptible to small-pox. If 19 out of every 20 persons are susceptible to small-pox by aerial infection, the chances are 19 to 1 that an exposed person will contract it; and if any person has not taken small-pox, the chances are 19 to 1 that he has not been exposed to it. If two persons in a family do not contract the disease, the chances are 19×19, or say $20 \times 20 = 400$ to 1 that they have not been exposed; and if three persons in a family do not contract it, the chances are $20 \times 20 \times 20 = 8{,}000$ to 1 that they have not been exposed to it.

† Negative evidence is, of course, valuable when compared with affirmative evidence, as indicating the infrequency or frequency of aerial convection, and it is to be hoped that as facts accumulate in regard to the whole question, full use will be made of the comparison; but Haygarth's doctrine was in effect that negative evidence is destructive of affirmative evidence.

who had it full out upon them." Haygarth here runs considerable risk of proving too much by his negative evidence.

Reviewing, shortly, the main points of this interesting correspondence, we find:—

1. That Waterhouse started with the opinions: (*a*) That the small-pox infection depended on variable conditions of virus of atmosphere, and of subject; (*b*) that it was a particulate poison; and (*c*) that, in regard to the extent of its atmospheric spread, affirmative evidence was valid, and that negative evidence was to be accounted for by one or more of the several variabilities.

2. That Haygarth held: (*a*) That the infection depended on practically fixed and unchanging conditions, alike as to virus, atmosphere, and subject; (*b*) that the virus was not particulate, but that at any given distance from its source the poison was equally dissolved throughout the whole atmosphere; and (*c*) that, therefore, negative evidence was much more valuable than affirmative evidence.

3. That Haygarth's pleading led Waterhouse to believe in this superiority of negative evidence, and that the next occurrence of small-pox in Boston furnished him with sufficient of such evidence to cause him to yield to Haygarth's views, that the spread of small-pox throughout the atmosphere was to be measured by a few inches, not by hundreds of feet or yards, and that even in a last-century dwelling-house it could not be carried by the atmosphere through an open door into an adjoining apartment.

To me Waterhouse's conversion seems a very high compliment to Haygarth's persuasive powers, rather than evidence of the truth of the thesis he sought to establish. In the present day it is not quite impossible that we are just a little in need of being warned by Waterhouse's example to avoid the pitfall into which he tumbled. We are perhaps too apt to forget that the aerial infectivity of small-pox may vary according to the intensity of the virus, the condition of the vehicle by which it is conveyed, and the state of the subject to whom it is conveyed.

About a year ago, when there seemed a likelihood of a prevalence of small-pox in Dumbartonshire, one of the points which I had before me as belonging to the teaching that an outbreak might afford, was this question of the aerial dissemination of the disease by hospitals. I therefore took account of the circumstances of one hospital which was likely to be used for Dumbartonshire small-pox, in order to see how its experience might be utilised in this connection. But at the very outset it became obvious that great, or even

insurmountable, difficulties stood in the way. The hospital, which contains altogether 100 beds, 80 being intended for fever and 20 for small-pox, is situated in the country about 1½ miles from the outskirts of Glasgow. Its single gateway opens into a public road. Closely adjoining it on one side is a considerable Board School. The school playground is separated from the hospital ground by a stone wall, and the school gate opens into the same public road 100 yards from the hospital gate. On the other side of the hospital are three rows of miners' houses with a population of about 450, the ends of the rows being close to the same public road, and all of them having their only opening into the road. The distance of the small-pox pavilion from the nearest dwelling-houses in this village is about 340 feet. A dirty ditch runs between the gardens attached to these houses and the hospital ground. On the opposite side of the road from the hospital are a few colliery houses, and the only outlet from these is into the same public road. Now, if I state regarding this population that small-pox began to spread in it within a fortnight of the hospital's containing a given number of acute small-pox cases, and that at the same time certain atmospheric conditions prevailed, and that the hospital administration was practically perfect, and that no small-pox patients walked in on their own feet, and that the ambulance man was a confirmed teetotaller—if all this and more be stated, I have yet considerable misgiving that a reply may be made that the existence of small-pox around the hospital is to be accounted for by personal communication; that the school children were bound to be running after the ambulance waggon; that intercourse must have gone on between the hospital and the village; and that, indeed, no such evidence can be accepted in favour of aerial convection. But, as a matter of fact I have no such story to tell. The general administrative precautions very much resembled those of the London hospitals in 1881. The nursing staff had an afternoon out every week, and were free on every second Sunday. The engineer and some of the ambulance staff lived outside the hospital. Coalmen, a plumber, a man to cut the grass, came and went; school children were sometimes on the road when the ambulance passed; and, in short, the usual possibilities of personal communication existed. But the number of acute cases in the hospital at any one time was small, and neither by aerial convection nor by personal conveyance did a single case occur in the families to which the school children belonged, nor in the mining village. If

I am right in supposing that spread of small-pox here would very likely have been attributed to personal communication, is the absence of small-pox to be set down to the want of ability of personal communication to spread the disease? If not, then we arrive at the position that such a hospital is capable only of telling, either affirmatively or negatively, in favour of personal communication, and never in favour of aerial conveyance.

The point of these observations is, that if we are to arrive at correct conclusions on this subject we must weigh the evidence carefully and fairly as between the *likelihood* of personal communication on the one hand and the *likelihood* of aerial convection on the other. We start with the assumption that small-pox may be conveyed either personally or aerially, and the matter in dispute seems to be narrowed down to this:—

1. Do we know personal conveyance of small-pox to be so very frequent and constant and certain in its operations as to justify us in thinking it the likelier way to account for all the facts of such very remarkable and repeated outbreaks as are recorded to have occurred in the areas around some of the Metropolitan Asylums Board's Hospitals, and especially around Fulham Hospital? or

2. Is it, on the other hand, likelier that some of the facts are to be attributed to an ability of small-pox virus under special conditions to be conveyed aerially to a distance considerably beyond that which has hitherto been generally admitted?

In a recent able report by a Medical Officer of Health the case was put thus:—

"Some observers, oblivious or regardless of the daily and hourly opportunities of small-pox infection being carried out of hospitals by the door, in their desire to account for outbreaks, have even gone so far as to maintain that it had flown out by the windows, and have professed to be able to measure such flights by the quarter mile." But the question here is: Whether does the small-pox contagium resemble more closely the cockroach, which crawls out at the door, or the house fly, which makes its escape by the window; or does it not rather find its analogy in those groups of insects which are provided both with running legs and with wings; and is it not our present object to judge as to which of the two possible methods of progression best explains certain facts belonging to its life history?

In the first place, regarding personal communication,

let me quote from a letter by Professor Wall, of Oxford, to Haygarth, contained in the work to which I have already referred:—"How comes it to pass that apothecaries, inoculators, nurses, etc., are continually going from house to house, while they are attending small-pox patients, without any care, and in ninety-nine cases out of a hundred without communicating the disorder to those who have not had it?" Is there not, after all, a good deal of truth behind this query? Everyone believes that a medical man *may* convey infection from one house to another; but if we consider the number of his outgoings from infected houses in any given week, or month, or year, even in the presence of a small-pox epidemic, or in his whole lifetime, and consider relatively to these the number of cases in which any atom of reasonable suspicion exists that he *has* conveyed disease, we get some indication of the value to attach to the entrances and exits belonging to hospital administration, many of them referring to tradesmen and others who never enter a ward, and have no direct opportunity of getting their clothing infected; while as to the nursing staff, the precautions observed as to the ablutions and change of clothing are far in excess of anything that is possible to a general practitioner. No doubt, however, it is here to be borne in mind that persons regularly on duty in a small-pox ward should require more thorough disinfection than a medical practitioner on his daily rounds.

One or two instances have struck me particularly in reading the more recent literature that has grown up around this question. The dustman of one of the M. A. B. hospitals caught small-pox, and though doubtless removed to hospital immediately on the disease declaring itself, he yet succeeded in infecting members of his own household. These people, therefore, were susceptible to small-pox. But, for years before, that dustman had been going in and out of the hospital carrying on his work of refuse removal there, and in and out of his own home, yet he had never brought infection within his doors till he himself was seized with the disease. Similarly, in the course of the Fulham inquiry, no case was found of small-pox occurrence in the houses visited by officers and servants of the hospital, and nine non-resident servants did not carry the disease to their houses in nine different streets. Again, in considering one particular group of cases thought to be due to aerial convection, Mr. Power tried to exclude all as to which personal conveyance could be in the least suspected. One excluded case was that of a man who had had a drink in a beershop

along with the driver of an ambulance waggon. How many other people may have been drinking at that time, or on other journeys, along with this driver, and yet not have been infected by him?

This question of the influence of ambulances in spreading the disease around hospitals was before the Commission of 1881 at some length. On one hand it was in evidence that the service was sometimes badly managed; that the driver might stop at a public-house on the way; that children might hang on behind the van. On the other hand it happened that some ambulance routes were pretty well fixed, especially near the hospitals, and that in the streets regularly traversed by them there was no special prevalence of the disease. This fact is noted not only regarding Fulham Hospital, but also by Dr. Bristowe as to Deptford Hospital; indeed, examination of details seems to show that the quadrant of the mile circle, containing the chief line of human intercourse with Fulham Hospital, chanced in 1881 to have a smaller percentage of its houses attacked by small-pox than any of the other three quadrants. It is true that people living in one street might encounter the ambulance in another, and go home and lie down with the disease a fortnight later. But it is equally true that on any sufficient basis of facts a larger proportion of people belonging to the streets traversed by the vans would be exposed to the ambulance influence, than of people belonging to other streets. And in regard to those who met the van in one street and lived elsewhere, it would be a very extraordinary thing if the houses to which these people returned happened to be arranged in numbers diminishing regularly according to the distance from the hospital to which the van was travelling. It would be still more extraordinary if this same regularity of arrangement were found to repeat itself around the same hospital in epidemic after epidemic. It is a remarkable fact that one witness who maintained the view that hospitals were not centres of infection, either aerially or by personal transmission, pointed in support of his thesis to one street in particular, a lane only 10 feet wide, closely adjoining Homerton Hospital, and forming a passage for nearly all the ambulances that entered its gates. There had been only one small-pox death belonging to this street in the decade 1871-80; but, on turning to the number of inhabitants attacked in this thoroughfare, I find from Dr. Tripe's figures that they amounted to 13 per cent. of the average total of inhabitants, a proportion which, in comparison with that of the adjoining streets through which

the ambulance did not habitually pass, was higher than some and lower than others.

Similarly, it was pointed out that some of the persons attacked within the "special area" surrounding the hospital might have got their infection in other parts of London to which their daily avocations took them. This is so; but again, is it likely that these people would come home and settle themselves down in regularly decreasing circles around the small-pox hospital? It is not to be denied, however, that, excluding ambulances which had pretty clearly defined routes of traffic to the hospital, and excluding introductions of the disease from other parts of the Metropolis, such small-pox as depended on personal communication from the hospital would tend to range itself in radii corresponding to the lines of communication with the hospital, the amount decreasing with the distance. And I do not for a moment suggest that personal conveyance of one sort and another had not a great deal to do with the matter. Here, as elsewhere, many groups of cases would be secondary to, and directly connected with, foci outside of the hospital, and it is in no way surprising that evidence of conveyance of this sort was able to be put before the Commission. But such foci, unless the mischief done by them was always equal, might tend rather to disturb than to emphasize gradation from centre to periphery; and it appears that in the locality around Fulham Hospital practically all cases were sent to hospital after their discovery. It has never been suggested, however, that aerial convection excludes personal communication, or that the area around the hospital forms an unsuitable field for the latter method of spreading the disease. The question is, Is personal communication the likeliest way to account for *all* the facts?

Coming now to the subject of aerial convection, both in Waterhouse's time and more recently, various theoretical considerations have been adduced with regard to the possibility of the survival of infective power through the requisite space for the requisite time. The distance to which an animal odour like the smell of the skunk can be carried, and the phenomena of hay fever, are instances in point. Too much value may easily be attached to such analogies, and they might be used in support of a thesis that measles, or whooping-cough, or typhus, can be conveyed for long distances. I may note, however, that Dr. Waterhouse quotes from Dr. Aspinwall to the effect that "it is a fact well known to every ploughboy, that a skunk can be

smelt much further in a dampish, foggy evening than in serene weather". The length of time during which a lancet charged with small-pox matter can retain its inoculative power is more to the purpose, but very exact and careful observations would be needed to give evidence of value here. All we seem to know is, that certain animal emanations are not affected by long travelling through the atmosphere, but whether or not this is true of small-pox under any circumstances is a question that must be settled by evidence. There may be very important distinctions between the length of duration of the quality of smell by non-living material, and the length of duration of powers belonging to what current pathology teaches to be a contagium vivum. Probably, however, Sir Thomas Watson fairly represents the consensus of opinion in his own day when he says, "There is no contagion so strong and sure as that of small-pox, none that operates at so great a distance."

Throughout this paper I am assuming that the members of the Epidemiological Society are well acquainted with the general lines of the Fulham investigation. I do not therefore propose to recapitulate the evidence, nor to point out how, when small-pox was not being received into the hospital, as in the periods antecedent to March 1877, and from the end of 1881 to May 1884, there was no special incidence of the disease in the one-mile area around the hospital, nor any regularity of distribution in quarter-mile belts within the mile area of such small-pox as did exist; nor how, on the other hand, when the hospital came to be in operation, its surrounding mile area became specially affected, and how at the same time the subdivisions of this area were affected relatively to their propinquity to the hospital; nor how these phenomena have been observed with remarkable regularity in one epidemic after another; nor how the parishes in which small-pox hospitals were completed in 1871, or afterwards, had their small-pox prevalence altered relatively to that of parishes which contained no such hospitals, so that some parishes which aforetime had been comparatively exempt from the influence of small-pox epidemics came under that influence to a very remarkable extent, and displaced other parishes which had formerly headed the list; nor how the positions of the parishes containing small-pox hospitals varied according as these hospitals were closed or in active operation.

In the evidence given before the Royal Commission, two groups of cases occurring within the "special area" of

Fulham Hospital yield an interesting comparison. The first group was reported by Dr. Dudfield, Medical Officer of Health for Kensington. It included 41 cases, occurring, after establishment of the epidemic, in Ifield Road, a thoroughfare about 800 feet from the hospital. Dr. Dudfield indicated that, as a rule, his main concern in such matters was rather with the stamping out of the epidemic than with the tracing of connections between cases, and that, indeed, much of such inquiry was usually made through inspectors. But nearly a year after the first of the cases had occurred, and after some of the people had left the locality and could not be found, he made more particular investigation, and succeeded in ascertaining personal communication from one to another of about half of these cases. They occurred, not simultaneously but in succession, and there can be no doubt as to the soundness of Dr. Dudfield's inferences of cause and effect between these cases.

The other group of cases to which I have referred is reported by Mr. Power. For four weeks after the opening of Fulham Hospital, near the end of 1880, there were no small-pox attacks in Chelsea, Fulham, and Kensington, the parishes nearest the hospital. In the next four weeks there were 11 attacks in these parishes, 7 being within the mile area. These were mostly explicable by personal communication. Then suddenly in the next fortnight the attack in the three parishes amounted to 62, of which 47 were in the special area, and 11 more within half-a-mile of it. Of households there were 56 attacked, 41 being within the special area, and 11 within another half-mile. Next it is noted, that of the 62 cases 42 were attacked during the five days Jan. 26-30, 32 being within the area and 8 more within half-a-mile of it. The facts as to these 32 were very carefully investigated, especially as regards their proceedings a fortnight previously. In 9 cases reasonable suspicion could be entertained of infection from personal communication. As to the other 23, no such evidence was obtainable. The cases were dotted all through the populated part of the special area, and were unconnected with each other, and with any known source or sources of infection, either from hospital intercourse or otherwise. At the time when they must have been infected only one case of the disease, so far as most elaborate inquiry could ascertain, existed in the special area, and small-pox was almost absent not only from the three parishes, but also from the parishes lying between the hospital district and the East-end of London, where there was a certain prevalence of the disease. Meteoro-

logical inquiry elicited the fact that the period from Jan. 12th to Jan. 18th (that is, a fortnight preceding the outbreak) was "characterised by still, sometimes foggy, weather, with occasional light airs from nearly all points of the compass". These conditions singularly resemble those which Waterhouse had long before recorded as accompanying similar outbreaks; and, indeed, I may note in passing that the similarity of the conclusions arrived at by the two observers is a very striking fact in view of the obvious inacquaintance of the later investigator with the ground that had been traversed by the New-England Professor a hundred years before.

It is of great consequence here to note what were the inquiries made, so as to exclude the likelihood of personal conveyance. They were stated as follows before the Royal Commission: "I took all possible means. I did not finish off a case, so to speak, at one sitting, but went back to it, and, as well, got additional information from friends, and so on; and then I reconsidered the case, and tried, so to speak, to live over again the attacked person's life during the time when I regarded him as having become infected. And thus I returned again and again to a patient with a view of getting information upon a point I might have overlooked, or that he or his friends might have overlooked. A great many of the people got interested in the question, and thought the thing over with me. For instance, a commercial traveller sent home for all his official books as to his daily doings, and we went through the whole thing together, as to where he was at this and that hour on each of certain days. Wherever they could, the people helped me very much, and the neighbours helped me too. I do not think anything was missed, because I was morning, noon, and night in the hospital or about it, seeing the people and their friends. I used to deal with the patient in the first instance—that is, if he was well enough, and few were so ill in the early stage of their attack that they could not give account of themselves. I would first ask them questions as to whether there had been any illness in their house, however trivial, and then go through with them their doings on particular days, when I supposed they might have got their infection. I would ascertain whether on particular days they were in the district and where, or out of the district and where, with a view to ascertaining whether they could have got their small-pox within the district or outside of it. And I asked special questions as to whether they could have had communication with

antecedent cases that I knew of as having occurred in the district, and from which they might have got their infection. I cross-questioned them backwards and forwards in that way. Now and again I did get some sort of information, which led me at last to surmise that they might have come across small-pox infection irrespective of the hospital; but still, in the large majority of cases, I could not get even a suspicion of that sort. I was puzzled altogether about it."

It seems to me that there is a very obvious contrast between these two outbreaks, recorded respectively by Dr. Dudfield and Mr. Power. The one outbreak occurred after small-pox had been established in the district, the other preceded a general prevalence of the disease. The one outbreak belonged to a particular street, the other had its cases dotted all over the special area. The one outbreak had its items occurring in succession either of individuals or households; in the other outbreak the cases occurred simultaneously. In the one outbreak, 50 per cent. of the cases were traceable to personal communication, partly by means of lay inspectors mainly interested in isolation and disinfection, and partly long after the occurrences, by Dr. Dudfield's own special inquiry. The other outbreak gave no indication of causal relationship between 23 cases, even though investigated when the outbreak was in progress by a skilled inquirer specially bent on hunting out all possible sources of origin. Surely, if we accept the one outbreak as indicative of personal communication, we cannot logically refuse to accept the other as indicative of aerial convection. It happens, too, that of the cases recorded by Mr. Power as belonging to the special outbreak of Jan. 26-30th, twelve occurred in Kensington, and, therefore, in Dr. Dudfield's own territory; and I learn from the proceedings of the Commission that, in view of Mr. Power's report, Dr. Dudfield had set himself to investigate these twelve cases, again mainly at a considerable interval after their occurrence. Like Mr. Power, however, he entirely failed to get any trace of their origin, so that we have here a most competent observer who successfully traced, even under the difficulties mentioned, 50 per cent. of one set of cases, and yet was quite baffled by another set which had equally baffled a previous inquirer.

In his evidence before the Commission, Sir John Simon, with characteristic caution, stated that while he attached great weight to the evidence already produced in support of aerial convection, he would wait for further confirmatory

evidence. This requirement has to a great extent been fulfilled. As a result of the original inquiry, and of the work of the Royal Commission, Fulham Hospital was put on its mettle. Those in charge of it knew how much might depend on their success or failure in preventing the spread of infection by personal communication, and we need not doubt that no stone was left unturned in the endeavour to prevent subsequent confusion of issue. The outgoings of the staff were reduced to a minimum, and increased stringency was observed in every detail. Yet, when the next outbreak occurred in 1884-85, the result was practically as before. All the extra care taken failed to lessen the incidence in the special area per 100 admissions of acute cases to the hospital. Indeed, the number of acute cases within it was remarkably small when, in the presence of weather conditions resembling those formerly noted, a "special area" outburst occurred. It was further observed, however, that these meteorological conditions, repeating themselves subsequently, were not always accompanied by increased infection around the hospital. In view of such facts, it is obvious that there is still much to learn regarding the whole question, and it is open to us to speculate whether the rhythm of epidemic and non-epidemic periods includes, as by analogy we may easily believe it to include, lesser rhythms of ebb and flow of infectivity, having to do not with whole seasons, but with weeks or days. In this aspect of it, such special outbursts as have been noted might be looked on as spring-tides of infection.

From October 1884, a part of Fulham Hospital not previously used for scarlet fever came to be devoted to that disease. The management, as regards laundry, nurses, and servants, was quite separate from that of the small-pox wards, the only official in common being the medical attendant, who, of course, was well aware of what had been alleged regarding personal communication, and who, we may assume, was correspondingly careful. In the fortnight ending Dec. 6th, following the opening of these scarlatina wards, there was great increase in the admission of acute cases of small-pox, and excessive spread of the disease in the special area. At this time, four cases convalescent from scarlet fever were attacked by small-pox, and all the others were at once re-vaccinated. These four cases constituted 10 per cent. of the total scarlet-fever cases. But no small-pox case was attacked by scarlatina; and it is noteworthy that the hospital did not act as a centre for the spread of scarlet fever or typhus, or any other such disease, in the

special area. We know very well that these diseases, and especially scarlet fever, can be conveyed by personal communication; but, as a matter of fact, the administrative procedure of the hospital did not spread even scarlet fever. If it be replied, that perhaps small-pox is conveyable further and more surely by fomites than is scarlet fever, the comment is obvious, that in that case small-pox is likely also to be further conveyable atmospherically.

In conversation recently with Dr. Ernest Marsh, who had charge of the small-pox wards at Belvidere Hospital during the past year, I was informed that one scarlet-fever ward had its windows 48 feet from the nearest small-pox ward, and that the only one of the scarlet-fever patients whose vaccination was neglected to be attended to, was a little American boy who had never been vaccinated, and who straightway was attacked by severe small-pox. The administration here was entirely separate, even as to medical attendance, and a barricade 13 feet high separated the one part of the hospital grounds from the other. Similar instances of aerial convection measured by feet are not uncommon, and the facts are, of course, much more easily proved than where hundreds of yards are in question. Dr. Septimus Gibbons mentioned to the Commission a case in which a distance of 20 yards intervened; Dr. Richardson a case of 30 feet; and Dr. Munk a case of 41 feet, and so on. And long before the theory of distant aerial convection was formulated, Drs. Gregory and Marson, of the original Small-pox Hospital, strongly insisted on a belt of 150 feet around the hospital, and their successor, Dr. Munk, supported the same view before the Commission.

I have already incidentally mentioned, as part of the thesis of aerial convection, that it depends on acute cases, not on convalescents. Probably it will not be denied that personal communication, both of scarlet fever and of small-pox, is likely to occur during desquamation in the one case, and separation of the crusts in the other. But one of the earliest facts ascertained as to Fulham Hospital was, that when it was devoted entirely to convalescents who were conveyed there in large numbers under the same ambulance arrangements as were criticised when acute cases were in question, small-pox did not spread in the special area. At that time the outgoings of servants, and visitors, and tradesmen were singularly powerless. At Darenth Hospital 600 convalescents failed to spread the disease. As with regard to distance, so with regard to limitation of admissions of acute cases, there is observable

a tendency to give effect to the thesis while not formally adopting it. Various witnesses mentioned various numbers to which they would restrict the totals of cases under treatment in any hospital. Of mixed cases, such figures as 150, or 100, or 80 were given; and of acute cases, one witness said 50 or 60, another 20, and so on; and in later epidemics the numbers in the intra-urban hospitals were limited first to 50, afterwards to 25, and finally small-pox was altogether excluded from them.

The above are the main points that have impressed themselves on me as supporting the view that small-pox may sometimes be aerially conveyed to a relatively long distance. It is not my purpose to do more than refer to the confirmatory evidence recently yielded by the outbreaks in Oldham and Warrington as recorded by Drs. Niven and Gornall. Probably here, as elsewhere, both agencies may have been at work, but it is certainly of consequence that these observers have not been able to account for some of the facts that came before them unless by acceptance of the atmospheric theory. In the course of his Report for 1893 Dr. Niven says:—"Is this increased incidence round Westhulme Hospital due to aerial diffusion, or to faulty administration of the hospital, leading to direct contact between the untraced cases and the officials of the hospital a fortnight before their attacks? I may say at once that I am satisfied that no such contact has taken place. Whether in isolated instances small-pox may have been caught by coming too near the hospital it is difficult to say. For the most part that possibility could be excluded." Dr. Gornall says:—"The statistics as to the relative incidence upon the specially afflicted area and its several parts most clearly agree with what we should expect with *air-borne infection* as the explanation of our difficulties." As to foreign evidence, a paper by Sir John Cormack, in the *Edinburgh Medical Journal* for 1881, shows that in Paris facts more or less similar had been observed in connection with hospitals there.

Of the arguments urged against the theory, by far the most striking is that regarding the incidence of the disease on certain institutional populations within the special areas. These, indeed, claim to furnish a series of control experiments in which absence of small-pox was suggested to be due to absence of personal communication as a result of careful administration. One of the members of the Royal Commission put the case very strongly to a witness who

inclined to support the theory of aerial convection. He referred to "the fact that in some cases workhouses are actually overlooking the grounds of a small-pox hospital with actual immunity from small-pox". Similarly, Dr. Dudfield in his evidence said:—"You know the case of Homerton Hospital, which is from 90 to 100 feet distant from the City of London Infirmary, in which no case of small-pox has occurred since the hospital has existed: that is a case which I have very much relied upon myself, and I know it has had great weight with my colleagues, the medical officers of health." With reference to the same institution, the Commissioners stated in their Report that "the workhouse had scarcely any cases in the epidemics of 1871-77 when the disease was extremely prevalent in the surrounding streets, although at that time the inmates were not protected by re-vaccination. The same may be said of the Hackney Union Workhouse and Infirmary, which are about a quarter of a mile from the Homerton Small-pox Hospital."

The strength of the argument thus set up against aerial convection is so obvious that it is of importance to look into the details of the facts on which the argument is based. The institutions in question were of two classes, workhouses and Poor-law infirmaries, the former being capable of much more thorough protection against personal communication than the latter. Eight of such institutions were mentioned, four being about half a mile from Fulham Hospital; one about a quarter of a mile and another about 200 feet from Highgate Hospital; one (Hackney Workhouse) about a quarter of a mile and another (the City of London Workhouse) about 100 to 200 feet from Homerton Hospital. No details are given as to the institutions related to Fulham Hospital, but, as the distance was considerable, this absence of information is of less consequence, especially as the fullest statement of facts has to do with the institution which was nearest to a small-pox hospital, viz., the City of London Workhouse adjoining Homerton Hospital. In Dr. Bridges' Report of January 1881, republished by the Royal Commission, he wrote:—"I have made careful inquiry for any case of small-pox occurring in this Workhouse during the present or previous epidemics among the inmates, but I have only been able to find one, and this one not attributable to the hospital." It seems likely that this statement may have been that which weighed with Dr. Dudfield and the medical officers of health, and which was also in the mind of the member of

the Royal Commission in the above quotation. But in Dr. Bridges' evidence before the Commission, nearly a year later than the date of his Report, he puts the case less decidedly in these words: "I have stated in my Report that in the City of London Workhouse . . . . very few cases of small-pox have occurred." Subsequently, Dr. Aveling, the medical officer of the workhouse, put the exact figures before the Commission (Qs. 5037 and 5059-60). He stated that 17 cases had occurred in the eleven years ending December 31st, 1881, and that certainly 12, and possibly 15, of these contracted the disease within the institution. The number of inmates is given as 450. Next, the facts as to vaccination require careful attention. In the decade there were three epidemics, the first being by far the worst. The second began about the beginning of the summer of 1876, and may be said to have extended to the end of the summer of 1879. It caused about 3,600 deaths in London. Some 650 of these occurred previous to the end of 1876, and the remainder (approaching 3,000) after that date. Now Dr. Aveling states (Q. 5043) that in the workhouse "re-vaccination was begun properly at the end of 1876, so that these eleven years are divided into two series, of six years when re-vaccination was not properly enforced, and a subsequent period of five years when it was tolerably enforced". As to the second epidemic, therefore, we see that less than one-fifth of it had passed before general re-vaccination was instituted, and it is to be particularly noted that of the total 17 cases, 13 occurred in the period ending 1876. In the various streets within a quarter-mile radius of the hospital, the proportion of the population attacked in the ten years 1871-80 ranged from 4 per cent. to 25 per cent., the average being 9 per cent.* In the workhouse, on the other hand, only some 3 per cent. were attacked. The difference is certainly considerable. But the fact that the cases in the workhouse practically stopped after 1876, when re-vaccination became part of the administrative system, goes far to account for the low attack rate calculated over the whole eleven years. Whether, in addition, anything is to be attributed to the age-distribution of the workhouse inmates, or to previous small-pox, or to the well-regulated conditions as to ventilation, cleanliness, etc., under which they were compelled to live, are questions as to which I have no information. But, on the hypothesis of atmospheric diffusion, it seems likely that people who are mainly kept within doors will be less

* See Table, p. 48, *Roy. Com. Report.*

exposed to infection than persons who walk abroad in the special area without restriction of any kind. In regard, however, to the whole comparison, it is to be borne in mind that the theory of aerial convection does not exclude that of personal communication; and in addition to the influence of re-vaccination, some part of the difference above indicated may well be due to excess of personal communication outside of the institutions as compared with the amount inside. Indeed, it is interesting to notice how this very theory comes in with regard to these workhouse cases. The general thesis was that the absence of small-pox was due to the absence of personal communication, and that in particular this absence of personal communication was characteristic of workhouses rather than Poor-law hospitals. But when attention was fastened on the fact that not 1, but 12 or 15 cases *had* occurred within the workhouse, then at once it was adduced in explanation that "the visiting had only been stopped at one place one time, and that for a very short time. Visitors came once a month."

In Hackney Workhouse and Infirmary, which was about a quarter of a mile from the hospital, and had in the eleven years 1870-81 an average of 643 inmates, the total number of small-pox cases originating within it amounted to about 20—again about 3 per cent. It was the custom here to vaccinate very early all children born in the institution, and to offer re-vaccination to all the inmates, but a good many refused it. The facts, therefore, are not unlike those relating to the City of London Workhouse. As to the other institutions mentioned, their officials were not called on for evidence, so that detailed examination of the figures cannot be made.

In going over this part of the evidence in the Royal Commission's Report, I made a note to this effect: Were there no other equal populations, not institutional (and, therefore, with no check on personal communication), within the special area which equally escaped? And near the end of my reading I found attention called to the fact that within a quarter of a mile of Fulham Hospital, within the north-west segment of the circle, there were 121 houses which had entirely escaped from 25th May to the middle of September, though 153 admissions into the hospital had taken place during that time. Here, then, was a place which, as regards administrative effort within it to prevent personal communication, was at the opposite pole from the workhouses, but which yet had not a single case of small-

pox during these months. The evidence, however, was adduced, not to throw doubt on the power of personal communication, but on that of the rival theory of aerial convection. But surely the facts are as applicable to the one theory as to the other.

On the whole, I do not think that this evidence regarding these institutions can be looked on as at all sufficient to counterbalance the evidence on the other side.

The practical conclusion of this whole question may be said to have already been arrived at. Small-pox hospitals are not now erected in the midst of towns, and those already in existence are being more and more sparingly used. Indeed, where the power of aerial convection is still doubted, it seems to be assumed that the prevention of personal communication is impracticable, and that accidents incident to the system of hospital treatment of small-pox within populous districts must be accepted as inevitable, so that the only remedy under the one theory, as under the other, is the removal of such institutions to a distance from populous places.

Summing up the evidence, so far as it is possible to sum up on a subject as to which so much is still to be learned, we seem to reach the general conclusion that, as a result of the simultaneous action of causes favourable to the spread of infection, the contagion of small-pox may be conveyed atmospherically to a distance much greater than had been usually admitted, a distance measurable by quarters of miles. In endeavouring to summarise the agencies which have to do with this result, it is necessary to bear in mind that other unknown agencies may also be involved, and that sometimes the joint action of all the known agencies may not be necessary, special activity of some, perhaps, atoning for relative deficiency or absence, and *vice versâ*, of others. Keeping this in view, the factors whose coincident operation can produce the result in question may be subdivided as having to do with: 1, The contagium; 2, The atmosphere; and 3, The population.

1. There must apparently be intensity of virus depending on (*a*) the period of the epidemic, a rising epidemic being important, and (*b*) concentration of acute cases as centres of infection. (*c*) There are apparently also minor waves of epidemicity referring to particular days or weeks, these waves constituting flood-tides of infectivity.

2. (*a*) A foggy condition of atmosphere or light winds appear to be of consequence, as observed both by Waterhouse and Power; (*b*) possibly *only* the atmosphere of

towns or cities may possess the necessary carrying power. No good evidence has yet been adduced of such occurrences in connection with hospitals situated in rural districts; but, no doubt, the failure here may be as much owing to want of population as to atmospheric condition.

3. Bearing in mind the conclusions arrived at by Dr. Whitelegge in his Milroy Lectures, it may well be the case that part of the influence of a rising epidemic is due to the existence in any special area of a greater or less number of persons specially susceptible to small-pox, and easily infected by its first active onset. The supply of such persons would be rapidly diminished or exhausted, and would not be renewed in the course of any single epidemic.

A CONTRIBUTION TO THE EPIDEMIOLOGY OF CHOLERA IN RUSSIA.

By FRANK G. CLEMOW, M.D.

(*Read: February 21st*, 1894.)

THE life history of an epidemic disease, in all its manifold relations, is perhaps one of the most interesting studies in the whole range of medicine. But the attainment of complete knowledge of a malady which, like cholera, has occurred in every quarter of the habitable globe, and in almost every country and clime, is fraught with no little difficulty. The literature of cholera is ever on the increase, and a glance at any standard bibliography of the disease brings with it a clear conviction of the impossibility of any one man becoming acquainted with all that has been written upon past epidemics. Fortunately, a perusal of all that has been written upon cholera is as unnecessary to a general understanding of the disease as it is impossible. But it has to be added that the literature of cholera is in some respects yet incomplete. There is one country at least, and there may perhaps be others, where wide-spread epidemics of cholera have offered a splendid field for studying the life history of the disease, but where the records, written in a language unfamiliar to most people in other countries, have either remained altogether outside the studies of observers in those countries, or have at most been very imperfectly included in their studies. References to past epidemics in Russia to be met with in English books upon cholera are strikingly few, and those that may be found are very imperfect. This is the more striking in face of the fairly extensive Russian literature that exists upon this subject.

The present epidemic has added immensely to the store of records already existing in Russia, and I thought it might not prove without interest to communicate to this Society some of the facts of the epidemic before they pass for ever into what may be termed, so far as the English-speaking medical world is concerned, the limbo of Russian Blue-Books and official reports.

Nearly two years have now passed since cholera made its reappearance in Europe. Germany, France, Austro-Hungary, Italy, Turkey, Roumania, Belgium, Holland, and England, have all in varying degrees suffered from the pest, but in none of these countries could the epidemic compare in extent and fatality with that in Russia. In the countries named cholera appeared in the form of more or less isolated, localised outbreaks; in Russia it spread over the whole land, only two districts (the government of Archangel and the principality of Finland) out of this immense empire escaping its ravages altogether. In the Western countries the total losses by death from cholera have been comparatively small, while in the country ruled over by the Tsar rather more than a third of a million of human beings have fallen victims to the disorder. Since the month of May 1892, when the germs of the disease first penetrated to Russia, cholera has never been wholly absent from the country. During the winter of 1892-3, however, the epidemic shrank to very small proportions, and in April of last year almost approached extinction. In that month there were reported for the whole empire only 80 cases and 30 deaths. But the breathing space was short, and with the advent of warmer weather cholera again became active, though not to the same extent nor with the same fatal virulence as in the preceding year.

Podolia, and the governments which make up the region formerly known as the Ukraine, or Borderland, it is true, suffered terribly in the past summer and autumn. But elsewhere in Russia the epidemic of 1893 must be counted as a light one in comparison with that of 1892.

Last year the Medical Department in St. Petersburg received returns of 102,296 cases of cholera, and 42,599 deaths; in 1892 the cases numbered 601,243, and the deaths 295,175. The cases in 1893 were rather more than one-sixth, the deaths about one-seventh, of those in 1892. Therefore, so far as may be gathered from these figures, the cholera infection was not only not nearly so widely diffused throughout Russia in the second summer of its prevalence, but was also considerably less fatal in its results. The death-rate in 1892 was 49 per cent. for the whole empire; in 1893 it was 41.6.

Some interesting facts are to be learnt from the distribution of the disease in the two successive years. In 1892 the centre of epidemic intensity was in the Caucasus, in the government of Astrakhan and the territory of the Don Cossacks, and there was a very sensible gradation in

the severity of cholera incidence from the south-east to the north-west. In 1893, on the other hand, the epidemic was worst in Podolia and the Ukraine, and there was no definite gradation in intensity in any particular direction. This might have been anticipated from the different history of the two epidemics. In the first, cholera was imported to Russia in the south-east, and thence overspread the country, apparently losing in virulence as it proceeded; while in the second there was no steady progression of a newly imported infection, but rather a revival in activity of an everywhere present infection after a temporarily lessened activity during the winter months, so that the cholera epidemic of last year presented the character of a number of more or less simultaneous outbreaks in centres scattered over the whole country.

But what is most notable with regard to the distribution of cholera in the two years is the fact that those districts which suffered most severely in 1892 escaped almost unscathed in 1893. This is most clearly seen in the two shaded maps* that I have prepared, founded upon the statistics of the two epidemics. It will be noted that the regions shaded most deeply upon the first map, are almost colourless upon the second map. The same fact is also clearly brought out by the diagram marked A, in which the pink colour, representing the cholera cases in 1893, is inversely proportioned to the blue colour representing the cases for 1892. This diagram, as well as the smaller coloured charts, showing the distribution of cholera in Russia in successive weeks, is the property of the Medical Department of the Russian Ministry of the Interior. I am indebted to His Excellency Dr. Ragozin, the Director of the Department, for his courtesy in lending me the original drawings, in order to show them to the Society this evening.

Finally, the difference in the distribution of cholera between the two epidemics may be seen almost as rapidly by a glance at the table of statistics of cases and deaths in each year.†

It is particularly worthy of remark that in the provinces of Central Asia, where in 1892 over 50,000 cases were reported, there were only 41 cases in 1893; that in the Caucasus, which furnished the immense total of nearly 163,000 cases in 1892, there were less than 2,000 in 1893; and that the governments bordering the river Volga, which

* The maps, as well as the diagram and charts referred to later, were exhibited at the time the paper was read.

† See Table IV.

suffered more severely with cholera than any others in European Russia in 1892, escaped with about one-twelfth of the loss in 1893.

Of individual governments, it will be noted that Daghestan, where in 1892 nearly 40 per 1,000 of the inhabitants were seized with cholera (a higher proportion than in any other part of Russia, European or Asiatic), was last year entirely free from the disease, and that the same remark would almost apply to the government of Orenburg.

In certain districts, on the other hand, an increase in the numbers of cases and deaths was observed in the second year. This was most particularly noticeable in the governments of the Ukraine, particularly Podolia, which furnished the large total of 21,185 cases last year, as compared with 6,439 the year before, in one or two Polish governments, and in some others.

I turn to some considerations with regard to the influence of sex and age upon the incidence of cholera. With regard to the influence of sex, I have been able to collect from various sources, and put in tabular form, the statistics of 26,047 cases and 12,852 deaths.* So far as these figures go (and the places from which they are derived are fairly representative of all parts of Russia) they shew that a larger number of men suffer from cholera than of women. The cases are grouped in one series of columns, the deaths in another, and it may be pointed out that the totals are not altogether drawn from the same groups of individuals. In some instances the sex of the cases only could be obtained, in others only the sex of the persons who died. And yet the proportion in each group is almost exactly the same, 60 per cent. of males to 40 per cent. of females. In other words, for every two females who contracted cholera three males were attacked with the disease. I am unfortunately unable to give the sex distribution of the population in the various places named, but if in these places the general rule obtains that is applicable to most mixed communities, that the female sex is in larger numbers than the male, the figures in the table become still more striking, and tend to shew that males are at least 50 per cent. more liable than females to contract cholera.

It is tempting to ascribe this greater incidence in males to the greater exposure of men to infection, and such a theory finds some support in the fact that in many places in the Caucasus, where the women joined in the field labours

* See Table I.

of the men, they were attacked in as large or even larger numbers than the men.

It is also to be noted that the disease appeared to be generally rather more fatal in men than in women. The difference, however, was not great, and in a few instances the reverse was the case.

Taking those places on the table for which the details of both cases and deaths are given, and excluding Rostof-on-Don (where some special circumstances seem to have obtained) it is found that, out of a total of 17,328 cases, males died in the proportion of 49 per cent., and females in the proportion of 45 per cent.

Turning to the question of the age incidence of cholera, it would appear that by far the larger number of cases occurred among persons of young and middle adult life.* The third and fourth decades of life almost invariably furnished the largest numbers.

In the absence of knowledge of the age distribution of the population in the various places named in the tables, the full significance of these statistics cannot be brought out. But it will be noted that in every group of figures, from whatever source derived, and whether cases or deaths, but little short of half the totals fall within the period of life between the twentieth and fortieth years, and that so far it may be stated that cholera was, in the Russian epidemic of 1892, mainly a disease of adult life.

That age has a marked influence upon the fatality of the cholera process there can be very little doubt, and the experiences of Russian observers point clearly to childhood and old age as the periods of life least able to survive an attack of cholera. The curve of mortality was exactly the reverse of the curve formed by the actual numbers of cases. These last rose regularly from infancy to adult life, and fell in old age. The mortality curve, on the other hand, was high in the first ten years of life, fell in the second, and again gradually rose in each succeeding decade until above seventy, when recoveries were rare, but not unknown, while above eighty the cases ended fatally almost without exception.

But the most interesting of all questions connected with the subject of epidemic cholera are those which bear upon the etiology and mode of spread of the disease; and if much has been learned in this branch of the subject there is still much that remains obscure, and which can only be cleared up by careful study of the disease from every possible

* See Tables II and III.

point of view, and by constantly confronting the results arrived at by those who approach the study from one aspect, with the results of investigations from all other aspects.

Specialism is the inevitable tendency of modern medicine, and the study of cholera has not escaped this tendency. The discovery of a special form of bacillus, which is evidently closely connected with the symptoms of Asiatic cholera, has formed, as it were, a point around which almost all later investigations have centred. It has become the function of the bacteriologist to study the life history of the bacillus as observed outside the body, and it is now no small part of the clinician's duty to note its behaviour inside the body of the individual, and its connection with the various symptoms of the malady. But it is the part of the epidemiologist to investigate disease from a wider point of view, to study it as observed, not in individuals, but in communities, to follow an epidemic from its origin to its extinction, and, while bearing in mind the important evidence borne by the bacteriologist and the clinician, to take this in conjunction with the evidence derived from all other available sources. There is indeed no condition or circumstance existing at the time of an epidemic that he can afford to overlook in a systematic study of any disease.

My task to-night is, fortunately, less ambitious, as I do not propose to make a systematic study of cholera, but only to contribute to the mass of knowledge already accumulated some of the evidence derived from the behaviour of the disease in one particular part of the earth. Cholera has occurred epidemically in every European country, but in each there would appear to be some conditions peculiar to the country that modify the course of an epidemic, and Russia is no exception. One such condition was in action at the very beginning of the outbreak of 1892.

The population of Russia is in the main made up of peasantry occupied in agriculture. They are to a great extent tied to the soil by a system of land-holding which gives to each person his own plot of land to cultivate, and by a system of residential passports. But the binding of the peasant to his own particular village is by no means complete. In the spring, large numbers—to quote from a Russian official source, "hundreds and thousands"—of peasants flock to the provinces of the South and East to find employment on the more fertile soil of these regions.

The special name of "*otkhozhié promysly*", or distant labours, has been applied to this form of occupation.

In June 1892, the migration of peasants had already begun, when the outbreak of cholera in the south-eastern provinces drove back in crowds the panic-stricken labourers. It was these, as well as the inhabitants of Baku, Astrakhan, and other towns, that were the active agents in carrying the cholera infection up the Volga. It was this circumstance that caused the disease to be not confined entirely to the great tracks of communication, the rivers and railways, but to penetrate even to the most secluded and isolated villages. Further, in many governments, in those *uyezds* or districts which were known to furnish the largest proportion of "distant labourers", cholera was more widely diffused than in other districts. This was particularly noticed in the governments of Kazan* and Nijni Novgorod.†

In the government of Tula, on the other hand, the comparative lightness of the epidemic was ascribed by the authorities to the small number of "distant labourers" furnished by this government.‡

A second circumstance deserves mention, which, if not peculiar to Russia, is nevertheless unusually marked there, and that is the prominence and ubiquity of beggars. It is the custom at Russian funerals for the relations of the deceased to distribute sums of money to poor people, and a funeral consequently always attracts large numbers of the begging community. Not infrequently some of the clothes worn by the deceased are given away at the same time. It is, therefore, not surprising to find in the reports upon the cholera epidemic numberless instances where the spread of the disease from village to village could be traced to the movements of mendicants, who either themselves contracted cholera, or carried its germs in the money or clothes given to them.

But it was not only by the agency of beggars that the funeral ceremonies frequently led to the spread of cholera. It is customary in Russia on such occasions for all the friends of the deceased to follow the body to the grave and to return to the house, where the relations provide food

* Report on the Cholera Epidemic of 1892 in the Government of Kazan. Kazan, 1893.

† Report on the Cholera Epidemic of 1892 in the Government of Nijni Novgorod. Published by the Sanitary Commission, Nijni Novgorod, 1893.

‡ Report on the Cholera Epidemic in the Tula Government, by Dr. Ozerof.

and drink, and where something of the nature of an Irish "wake" frequently follows.

Such an observance is not confined to the poorer classes, and among the well-to-do the *Pominki*, or Memorial feast, becomes an elaborate dinner, from which, by some curious tradition, two dishes—caviare with pancakes, and rice with raisins—are rarely absent. Among poor people living in small cottages it is not difficult to understand how infectious disease may be spread by a number of persons collecting together and taking food in probably the same room where the patient has died, and whence the corpse has but just been removed; and it is a fact that in almost every report yet issued by local authorities upon the cholera epidemic, *Pominki* are stated to have been most powerful agencies in spreading the cholera infection in villages and country districts.

Vodka, the national rye-spirit, is generally largely drunk on these occasions, and the intoxication which frequently accompanies such gatherings deserves to be mentioned as an additional factor favouring the contraction of cholera.

Bazaars and fairs form another marked characteristic of Russian national life. Almost every town of any size has its fair once a year, or oftener. It was frequently noted that when the cholera epidemic broke out in such towns, they became centres of infection whence the peasants carried the disease to the surrounding villages.

In all the instances mentioned up to the present, direct transmission from person to person was the means by which cholera was spread.

I do not wish to imply that cholera is contagious, in the sense that typhus and scarlet fevers are contagious. With reasonable precautions, persons, though in constant and prolonged proximity to a cholera patient, may feel practically safe against catching the disease. The poison grows and multiplies in the alimentary canal, and exists in the evacuations of the patient, and, so far as our present knowledge goes, nowhere else. If sufficient precautions are taken to prevent the poisonous evacuations reaching directly or indirectly the alimentary canal of another person, that person will not contract cholera. But if these precautions are not taken, the probability is very great that the other person will sicken with the disease. And the Russian peasants as a rule did not take these precautions. They ate and drank in the same room where the cholera patients lay, they did not wash their hands before

eating, they did not disinfect them before leaving the room, they did not prevent the patient's stools and vomit from soaking into the floor and walls and furniture, and anything that happened to be lying near. When they went to bazaars and fairs and to religious services, they went in clothes that had been worn in the sick-room, and perhaps splashed with cholera evacuations. Further, the absence of precautions was frequently the result of religious or superstitious scruple.

In but too many instances the epidemic was accepted as a divine visitation. Fatalism led either to complete apathy, or to an active resentment of any interference with the decrees of Fate by the sanitary or medical officials. These considerations doubtless explain to a great extent the fact that in Russia, in the larger number of instances, cholera was spread directly from person to person. This might be termed the immediate method of cholera diffusion. There would appear to be, in addition, two mediate methods. In both the poison is transmitted in the evacuations of a cholera patient: in one case through the medium of fomites, in the other through the medium of water. I have not seen any evidence in the Russian epidemic of the poison being carried through the air by what some observers have termed cholera clouds. But in a considerable number of cases no connection could apparently be traced between the first cases of cholera in a district or house, and pre-existing cases elsewhere. These instances are of interest, as they appear at first sight to contradict the view that the evacuations of a cholera patient are a necessary factor in the production of a fresh case of cholera, and might be held to support the view that, given certain conditions of atmosphere, soil, and water, cholera may arise *de novo*.

It is necessary to keep an open mind with regard to the explanation of such instances, but at the same time it is necessary to remember how easily the links in the chain connecting the new cases with those already in existence may be overlooked. No better instance of this could be quoted than the outbreak of cholera in July 1892, in the Lunatic Asylum at Bonneval in France. The inmates of the asylum appeared to be totally cut off from all communication with the outside world, there was no possibility of the water-supply being contaminated, and yet on July 18th three women in the asylum sickened with cholera, and in less than a month 56 of the inmates were attacked with the disease and 34 died. The whole circumstance seemed

inexplicable, until Professors Brouardel and Thoinet were enabled by careful investigation to establish, link by link, a complete chain of connection between the three female lunatics at Bonneval on the one hand, and a case of cholera at Epinay on the other.*

Closely connected with the spread of cholera directly from person to person is the question of its spread by fomites. There would appear to be little doubt that the poison of cholera may attach itself to clothes and other articles, and that these may become means of spreading the infection. I have elsewhere brought together a number of instances where this occurred. The following additional instances are of interest.

In the Polish government of Lublin, it may be remembered that cholera was very severe in 1892. It appears that the infection was brought to the government in linen. A woman came from Rostof-on-Don, where she had been in contact with a child who died from cholera, to the village of Biskunitzé in Lublin. She did not herself contract the disease, but two days after her arrival a laundress who had washed her linen sickened and died from cholera,† and there seems little doubt that the linen was in this case the vehicle of infection.

The following instance points a double moral. At the beginning of August, a thief stole some articles that remained awaiting disinfection after the death of a cholera patient in a village in Daghestan. He returned with his spoil to his own town of Andii. On August 4th he and his wife both sickened with cholera and died the same day. Before the 10th his whole family, consisting of four children, died from cholera, and from these cases resulted directly a whole mass of others in the same quarter of the town.‡ Verily, honesty is the best policy!

The instances are too numerous to quote in detail, and have already been generally referred to, in which the clothes worn by cholera patients were given to beggars, and were thus the means of spreading the infection.

In a village called Miasoyedovo, in the government of Viatka, a body of workmen fleeing from the cholera districts passed along a certain road and threw down two pieces of rag. Some little time after two peasant women passed

* *Épidémie de Choléra à l'asile des aliénés de Bonneval* (Eure-et-Loir). Par MM. P. Brouardel et L. Thoinet. Paris, 1893.

† *The Cholera Epidemic in the Government and Town of Lublin*, by Dr. Skabitchevski.

‡ Report of the First Conference of Caucasian Physicians, *The Cholera Epidemic of* 1892 *in the Caucasus*, vol. ii. Tiflis, 1893.

along the same road and picked up the pieces of rag. On the following day the two women both sickened with cholera, and these were the first cases of the epidemic in the district.* It is evident from these instances that the cholera poison may exist outside the human body for some time, attached to clothes or other articles. It would be of interest to know whether in every such instance the clothes were damp or dry, in view of the well-known rapidly fatal effect of drying upon Koch's comma bacillus, but this is unfortunately not stated in the accounts quoted.

The case with which the cholera poison may be spread by means of water is so well known as to scarcely need the support of fresh evidence. If any such fresh evidence were needed it could be supplied in abundance from the observations made in Russia in the last two years. It would seem that even the largest body of water may not be sufficient to dilute and render innocuous the poisonous matter. The Volga, containing a greater stream of water than any other river in Europe, became in 1892 seriously contaminated with the virus of cholera. The main part played by this river in diffusing cholera was undoubtedly as the great highway of communication in that part of Russia, along which the crowd of panic-stricken persons from Astrakhan and the Caucasus fled. But there appears to be conclusive evidence that the river itself became a direct vehicle of the poison, and in the governments through which it flows there were numerous instances of cholera that could be directly traced to the consumption of the river water. The same appears to have been the case with the two great branches of the Volga, the rivers Kama and Viatka, and with the rivers Dnieper, Dniester, and Bug. There would appear also to be little doubt that, both last year and the year before, the water of the large canals that intersect St. Petersburg contained the cholera poison in sufficient quantity to cause many cases of the disease; and one observer in St. Petersburg recently stated that he had been able to isolate the comma bacillus from the waters of the Neva.

The part played by water on a smaller scale, by streams, by ponds, and tanks, in diffusing cholera was very considerable in the epidemic of 1892. A thousand instances might be quoted in which the clothes worn by a cholera patient were washed in a stream or pond, and water from these

* Report of the Fifth Conference of Medical Officers to the *Zemstvos* of the Kursk Government. Kursk, 1893.

sources gave rise to cholera in persons who drank it. The following histories are but types of an oft-repeated sequence of events.

On a certain river in the Viatka government cholera broke out in the village of Levashovo, and the linen of the sick was washed in the river. There were ten other villages upon the banks of the stream, one above Levashovo and nine below. The one above escaped cholera altogether. In seven of those below cholera became epidemic, and it was found that the two villages that escaped were the only two that had not taken their water-supply from the stream.*

In Studeni Kliutch, a large Tatar bazaar 37 versts from Kazan, the water-supply is obtained from a spring, over which are two large tanks, one higher than the other. The upper one is used for drinking-water, the lower for washing purposes. On July 13th, 1892, ten water-barrels belonging to Tatars were left soaking in the lower one, and the same afternoon the linen of a cholera patient was washed in the same tank. The barrels were next morning removed from the lower tank, filled from the upper one, and taken home to supply with drinking-water ten Tatar houses. On the next night but one, in nine of these ten houses persons were seized with cholera. There was no other obvious source of infection, and it appeared probable that the barrels, although filled at the upper tank, had still sufficient of the water from the lower tank adhering to them to convey the infection.†

The following instance shows the influence of human communication and of water-supply in spreading cholera. In a certain part of the government of Tomsk, in Siberia, a whole family started on their way to a village 25 versts away. After going some distance the daughter sickened with cholera, and all save the father returned to their starting-point. On their return the son sickened, then the *feldscher* who attended him. They all died. The disease then spread to those who washed the bodies of these unfortunate people. Meanwhile the father went on to a village called Polovinnaia, where he sickened and was found lying in agony in the road. He was removed to a house, and the same day the owner of the house sickened,

* *Materials Concerning the Cholera Epidemic of* 1892 *in the Government of Viatka.* Supplement to the Protocols of the Sixth Conference of Physicians in the Viatka Government. Viatka, 1893.

† The *Journal of the Medical Society of the Imperial University of Kazan,* 1893, vol. ii.

and later his wife. All the patients died. The disease then attacked those who washed their bodies, but was still confined to one half of the village. The village was divided into two parts by a broad stream crossed by a bridge. The peasants of the further side hearing of these cases of cholera, determined to allow no communication between the two halves of the village, and with that object broke down the bridge, and posted a body of twenty men to see that not a soul should cross the river. Unfortunately, however, the river itself still remained as a link between the two, and after the linen of the first cases had been washed in the river whence the peasants on the further bank drew their drinking-water, cholera as rapidly spread on the further as on the hither side.

In view of the affinity of the cholera poison for water, and the frequency with which it is carried in this medium, one is tempted to ask whether it is only coincidence, or something more, that has led the Russian peasant to conceive cholera under the form of a woman holding a bucket in either hand.

The immense, the overwhelming importance of a pure water-supply, free from the remote possibility of contamination by dejecta, as a safeguard against cholera, is a lesson that has been frequently taught before, but that derives a fresh significance from the experiences of the last two years in Russia and France and Germany.

The Volga and the Neva, the Seine and the Marne, the Elbe, and a score of smaller streams, are object-lessons that cannot be ignored. Nor can it be forgotten that one of these rivers at least was an active agent in the distribution of cholera, even after its water had been submitted to the ordinary processes of filtration.

The influence of weather upon a cholera epidemic has frequently been discussed, and there can be no doubt that the cholera virus finds much more favourable conditions for its spread in warm weather than in cold. A rise in activity in the summer months, and a fall frequently to total disappearance during the winter, has been the course followed by almost every epidemic of which records exist. It is, however, worthy of remark that the severest cold is not of itself sufficient to extinguish an epidemic. Although last winter was so intensely cold in Russia as to be declared by the authorities at the Central Physical Observatory in St. Petersburg to have been one of the severest winters, and in some respects the severest winter, on record even in Russia, yet cholera never wholly disappeared from the country.

In this connection some experiments made by a Russian observer on the effect of cold upon the comma bacillus are not without interest. Tubes containing the bacilli in cultivation were in one series of experiments buried in the earth, and in another were exposed to the air. The experiments were carried on during a period of considerable cold. It was found that both groups of bacilli survived exposure to a temperature constantly below freezing-point for as long as forty days, and that they did not lose their vitality, although the temperature on one occasion at least fell as low as 26° below the Réaumur zero, or 58½° of frost on the Fahrenheit scale.*

At present only isolated observations are available with regard to the influence of weather upon the recent epidemic in Russia, but on one point almost all the reports yet issued are agreed, and that is the increased prevalence of cholera after a light rainfall. This is, I believe, in accordance with the experience of observers in India, where cholera is said to be frequently lit up by light falls of rain after a drought, while the heavy tropical rains are said to have rather the reverse effect, and appear to aid in extinguishing an epidemic.

But the effect of weather and of other external agencies on the cholera poison is but one, and perhaps a small part of the problem of the causation of cholera. The most complete life history of the comma bacillus, even when it is proved beyond a doubt that this bacillus is the one cause, the *causa causans*, of Asiatic cholera, will not give an answer to many questions connected with the ætiology of the disease. The receptivity of the host is a factor that cannot be overlooked. All persons are not equally susceptible to the virus of cholera. Some would appear to be naturally immune to its attacks. Possibly the varying duration of the incubation period may be explained by a varying degree of resistance in the individual. The incubation period may, at any rate in some cases, be remarkably short, as shown by the following incident. In a certain village in the government of Viatka† a peasant died from cholera, and his body was removed to a cemetery in the village of Mojgu, five versts away. While passing through this village, the cart containing the corpse was followed by a little girl, eight years of age, who ran for some distance behind the cart, and once at least climbed on to it, and threw herself on to the coffin. Two hours later the little

* Dr. Vnukof, *Kazan Univ. Vratch*, No. 8, 1893.
† *Loc. cit.*

girl was seized with cholera and died the same evening. The next day her mother and sister sickened, but prompt measures were taken, and these were the only cases of cholera that occurred in that village. Here it would seem the incubation period was no longer than two hours.

There would appear to be a varying degree of resistance to cholera not only in different individuals, but also in the same individual at different times. That the susceptibility to cholera may be immensely increased by errors and excesses in diet is open to little doubt. I had the opportunity last summer of seeing many cases in the cholera hospitals of St. Petersburg and Moscow that could be traced directly to drinking-bouts, or to the excessive consumption of unripe fruit or vegetables, particularly melons and cucumbers, both of which are eaten in immense quantities in Russia.

The increased prevalence of cholera after fairs and bazaars and religious festivals may undoubtedly be explained by the rash dietetic indulgences that marked those occasions, as well as by the increased exposure to infection from the gathering together of large numbers of people. One such religious festival, the feast of the Preobrajenié or Transfiguration, was followed in many places by a greatly increased activity in the cholera epidemic. The blessing of the apples by the Church on that day naturally caused an immense quantity of fruit, much of it unripe at so early a date (the 6th of August), to be eaten by the peasants; and it was the unripe fruit, as much as the increased contact with other persons in crowded churches and religious processions, that caused the greater numbers of cases of cholera after this date. In one instance a man who died from cholera had eaten 7 lb. of apples at a sitting![*]

Finally, it would seem that some persons, however much they may be exposed to the infection of cholera, are incapable of contracting the disease. Such people appear to possess a natural immunity to the cholera poison. How otherwise can the following instances be explained?

In the Cossack stanitza or village of Prokhladnaia in the Caucasus a family of nine persons occupied two small dark damp rooms. The mother sickened with cholera, and the children played about on the earthen floor, which was soaked with the stools and vomit of the patient. The whole family ate and drank in the room where the patient

* Report on the Cholera Epidemic of 1892 in the Government of Kazan. Kazan, 1893.

lay, and the stores of food were all kept in the same room, and yet not one other member of the family had even an attack of diarrhœa.*

The following instance is equally remarkable. In a village in the government of Kursk fifteen members of a family lived under the same roof. The mother returning from the market town, where cholera was present, sickened with the disease. She first lay for some time in the yard outside the hut, later just inside the hut, and finally in the one room of the hut itself. The author of this report states that he found the places where she had lain in the yard, the entrance and the hut itself, simply soaking with cholera discharges. He found one close, stuffy, dirty room and fifteen souls of a hungry family in constant close contact with the patient and the discharges. "And with what result?" he asks. "That from that day to this there has not been a single further case of cholera in that family."†

Closely connected with the question of individual susceptibility or immunity to cholera is the question whether racial differences have any influence upon the degree of resistance to the poison of the disease. In some parts of Russia it was noticed that there was a difference in the incidence of cholera in different races inhabiting the same town or district. The Report of the First Conference of Caucasian Physicians, published last year, contains some interesting evidence on this point. It appeared in many places that the native inhabitants of a district suffered considerably less than the aliens who had settled there. It was observed, for example, that in eighteen out of twenty-three sub-districts into which the military district of the Black Sea and Kuban is divided, the death-rate among aliens was immensely higher, sometimes twice or thrice higher, than among the natives. In the Cossack stanitza of Prokhladnaia already mentioned, it was found that the Cossacks themselves suffered less than the members of other races that had settled there. In the province of Kars the Christian races were found to suffer more than Mohammedans, but in many other districts the reverse was the case. In Kars the Armenians suffered the most severely, then, in the order named, the Karapapakhs, Turks,

* Report of the First Conference of Caucasian Physicians, *The Cholera Epidemic of* 1892 *in the Caucasus.* Tiflis, 1893.

† Report of the Fifth Conference of Medical Officers to the *Zemstvos* of the Kursk Government. Kursk, 1893.

Greeks, Russian sectarians, while the Kurds and Turcomans suffered least of all.*

In all the villages of a certain *uyezd*, or district of the government of Viatka, it was noted that the Russian inhabitants escaped with a far lighter number of cases, and with a much smaller death-roll, than the other inhabitants, who were mostly Votiaks, a Finnish race found largely in the eastern half of the Viatka government.

In many of the instances quoted there appears to have been a vast diversity in the mode of life, intelligence, and general prosperity of the races named, and much of the difference in the severity of the cholera epidemic may have been due to these diversities rather than to racial variations. On this point the evidence is at present too imperfect to warrant the statement that race has a determining influence upon the severity or fatality of a cholera epidemic.

In conclusion, it may be well to briefly recapitulate some of the points that have been touched upon in the foregoing, and to bring to a focus some of the teaching of the past two years' experience of cholera in Russia.

1. A district which in the first year of an epidemic suffers severely, may be expected to escape lightly in the second year; and, to a certain extent, the reverse holds good.

2. Males and females are both liable to cholera, but in Russia more males than females contracted the disease. In males the death-rate was slightly higher than in females.

3. No age was exempt. Adults from 20 to 40 years of age furnished the largest number of cases. In children under 10 and in elderly people the disease proved more fatal than in people in the middle period of life.

4. In the recent Russian epidemic, cholera was mainly spread directly from person to person. It was also in some instances spread by means of fomites, and in others through water. In every such instance the poison was contained in the evacuations of a cholera patient. There is no evidence yet published of cholera having spread in Russia through the air by "cholera clouds".

5. The largest bodies of water may become dangerously contaminated by the cholera poison.

6. Too much stress cannot be laid upon the necessity of

* *Medico-Topographical Review of the Province of Kars*, "The Epidemic of Cholera in 1892," by Dr. Larin.

guarding all sources of drinking supply from the possibility of fæcal contamination.

7. Errors and excesses in diet may be largely instrumental in predisposing a person to cholera.

8. The severest degree of cold is not alone sufficient to extinguish an epidemic. Light rain-falls appear to favour the spread of an epidemic.

9. Individual susceptibility to cholera varies. Some persons seem to be naturally immune.

10. The incubation period of cholera varies in length. It may be as short as two hours.

11. Racial differences may have some influence upon the incidence of cholera, but the evidence is as yet imperfect upon this point.

TABLE I.

*Table shewing the Sex Incidence in 26,047 Cases of Cholera, and in 12,852 Deaths from the Disease.**

Name of Place or District.	CASES.				DEATHS.				Percentage of Deaths to Cases.	
	No. of Cases.		Per cent. Ratio.		No. of Cases.		Per cent. Ratio.			
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
St. Petersburg (1892)	—	—	—	—	1054	598	64	36	—	—
„ (1893)	—	—	—	—	1028	556	65	35	—	—
St. Petersburg (District of, 1892) ...	698	375	65	35	—	—	—	—	—	—
Moscow	981	357	73	27	529	191	73.5	26.5	53.9	53.5
Nijni Novgorod (three hospitals in) ...	1522	418	78	22	—	—	—	—	—	—
Yaroslavl (Government)	755	485	61	39	—	—	—	—	—	—
Kuban and Black Sea (Military Districts)	2349	2022	54	46	1219	921	57	43	52	45.5
Kaitago-Tabasaransk „ „ ...	1749	1363	56	44	758	576	57	43	43.3	42.2
Odessa (District)	405	448	47.5	52.5	177	163	52	48	43.7	36.4
Taraspol „	298	316	48.5	51.5	162	139	53.8	46.2	54.4	44
Alexandrinsk (District)	171	137	55.5	44.5	—	—	—	—	—	—
Elizavetgrad „	101	57	64	36	60	23	72	28	59.4	40.4
Kherson (Town)	465	317	59.4	40.6	239	162	59.6	40.4	51.4	51.1
Voronezh „	378	358	51.4	48.6	—	—	—	—	—	—
Kozlof „	628	720	46.6	53.4	262	322	45	55	41.7	44.7
Rostof-on-Don (Town)	2675	506	84	16	980	442	69	31	36.6	87.3
Kars „	769	557	58	42	313	211	60	40	40.7	38
Samara (2nd Cholera Hospital) ...	250	120	67.6	32.4	120	51	70	30	48	42 5
Andiiski (District)...	751	811	48	52	387	391	50	50	51.5	48
Stavropol (seven villages in Government of)	696	689	50	50	397	362	52.5	47.7	57	52.5
Dubinka (Cossack Stanitza)	103	138	42.7	57.3	—	—	—	—	—	—
Saratofski „ „	43	66	39.4	60.6	21	38	35.6	64.4	48.8	57.6
Total	15,787	10,260	60.6	39.4	7706	5146	60	40	—	—
	26.047				12,852 •					

* The figures in this and the following Tables are taken from local reports upon the cholera epidemic, issued by the *Zemstvos* or other governing bodies for the towns or districts named. Where not otherwise stated, the figures refer to the epidemic of 1892.

TABLE II.

Table shewing the Age Incidence in 19,345 Cases of Cholera, occurring in various parts of the Russian Empire.

Name of Place or District.	0-5 Yrs.	5-10 Yrs.	10-15 Yrs.	15-20 Yrs.	20-30 Yrs.	30-40 Yrs.	40-50 Yrs.	50-60 Yrs.	60-70 Yrs.	Over 70 Yrs.	Unknown.	Total.
Moscow	23	20	28	77	294	407	253	138	75	17	6	1338
Nijni Novgorod (three hospitals in) ...	59		205		511	602	375	196	64	26	2	2040
Yaroslavl (Government of)	52	33	147		268	302	194	118	70	30	—	1214
Tula „	146	81	50	117	225	201	136	82	56		—	1094
Kars „	114	90	78	102	416	264	145	68	26	23	—	1326
Odessa (District of)	103	96	55	114		227	98	42	109		9	853
Taraspol „	88		85		112	142	94	37	42		14	614
Alexandrinsk (District of)	34	35	35	41	62	37	26	17	23		—	310
Elizavetgrad „	13	23	8	13	17	35	20	12	9	5	3	158
Malmyjski „	18		50		42	44	42	21	18	13	—	248
Kuban and Black Sea (Military Districts) ...	108	145	135	191	681	707	472	280	245		—	2964
Kaitago-Tabasaransk (Military District) ...	179	228	255	299	732	633	341	349			96	3112
Kherson (Town)	113		92		194	129	102	83	47	11	11	782
Kozlof „	61	76	85	125	278	285	207	114	87	30	—	1348
Baku (Cholera Lazaret)	48		188		480	303	119	42	22	3	—	1210
Samara (2nd Cholera Hospital)	10		32		99	97	73	26	16	2	—	355
Prokhladnaia (Cossack Stanitza)	31	21	53		102	72	51	49			—	379
Total*	2048		2618		4555	4492	2748	1396	1347		141	19,345
Percentage of Total	10.6		13.5		23.5	23.2	14.2	7.2	7		.8	100

* In this and the following Table, where a number has applied to two or more age groups not corresponding to the age-group represented in the total, the number has been divided equally among the age-groups to which it applies. For instance, in Odessa 114 cases occurred between the ages 15 and 30. In obtaining the total, it has been assumed that 57 occurred between 15 and 20, and 57 between 20 and 30.

TABLE III.

Table shewing the Age Incidence in 13,550 *Deaths from Cholera, occurring in various parts of the Russian Empire.*

Name of Place or District.	0-5 Yrs.	5-10 Yrs.	10-15 Yrs.	15-20 Yrs.	20-30 Yrs.	30-40 Yrs.	40-50 Yrs.	50-60 Yrs.	60-70 Yrs.	Over 70 Yrs.	Unknown.	Total.
St. Petersburg (1892)	96	40	34	89	393	498	286	114	63	33	6	1652
„ (1893)	31	33	20	119	441	477	261	117	59	24	2	1584
Moscow	12	17	10	23	136	219	157	88	44	13	1	720
Nijni Novgorod	17	22	27	92	253	280	177	111	37	9	163	1188
Yaroslavl (Government of)	34	10	35		98	128	99	68	44	13	—	534
Tula „	48	17	9	15	59	58	49	33	29		—	317
Kars „	68	34	25	23	125	103	63	39	21	23	—	524
Odessa (District of)	47	27	14	23		93	39	21	73		3	340
Taraspol „	45		26		38	69	58	23	33		9	301
Alexandrinsk „	17	14	9	10	18	17	16	7	16		—	124
Elizavetgrad „	8	9	3	2	13	19	10	7	7	5	—	83
Kuban and Black Sea (Military Districts) ...	79	90	71	66	232	300	222	160	175		—	1395
Kaitago-Tabasaransk (Military District) ...	95	100	108	105	262	260	166	208			30	1334
Andiiski „ „ ...	23	24	14	9	30	50	59	37	24	20	—	290
Kherson (Town)	55		31		85	66	68	52	32	10	2	401
Kozlof „	36	38	31	32	101	110	91	66	57	22	—	534
Samara (2nd Cholera Hospital)	3		8		39	50	32	14	12	1	—	159
Prokhladnaia (Cossack Stanitza)	21	10	20		37	38	27		27		—	180
Sunjensk	196	183	201		273	331	383	143	72	53	—	1840
Total	1599		1292		2645	3166	2263	1184	1185		216	13,550
Percentage of Total	11.8		9.5		19.5	23.4	16.6	8.8	8.8		1.6	100

TABLE IV.*

Shewing the numbers of Cases of Cholera and Deaths from the Disease in the Russian Empire in the two years 1892 *and* 1893.

Name of Government or Province.	1893.		1892.	
	Cases.	Deaths.	Cases.	Deaths.
Astrakhan	567	295	17,721	11,122
Don Cossacks	2,875	1,450	37,439	18,280
Saratof	1,417	645	41,887	21,093
Samara	2,360	1,116	41,369	18,115
Simbirsk	1,149	536	17.143	7,347
Voronezh	2,721	1,402	24,025	12,072
Orenburg	9	1	12,015	6,434
Tambof	494	261	21,284	9,078
Lublin ...	61	31	6,282	2,643
Penza	169	73	7,394	3,309
Kursk	4,311	1,694	10,164	4,247
Kazan	2,404	1,149	11,112	5,225
Ufa	572	250	9,876	4,531
Viatka	600	286	10,746	4,981
Kief	7,679	2,858	12,569	4,697
St. Petersburg	4,015	1,682	5,423	1,602
Nijni Novgorod ...	2,349	1,234	4,383	1,917
Ekaterinoslav	2,432	1,094	4,353	1,953
Kharkof	1,038	554	6,243	2,569
Taurida	1,287	689	2,454	1,365
Kherson	1,876	842	5,452	2,522
Bessarabia	700	326	3,860	1,732
Podolia	21,185	7,593	6,439	2,292
Perm	170	84	4,205	2,052
Yaroslavl	1,030	492	1,241	548
Riazan	352	194	1,916	973
Tula	3,794	1,112	1,314	371
Orel	6,133	2,225	1,884	751
Poltava	1,313	601	1,992	863
Tchernigof	1,856	650	1,641	516
Radom	394	145	744	330
Moscow	3,518	1,537	1,618	841
Kielce	—	—	369	191
Volhynia	5,808	2,302	1,394	538
Kostroma	363	142	428	212
Olonetz	69	34	107	54
Vladimir	1,337	518	281	160
Warsaw	396	159	321	161
Mogilef	2,288	868	301	109
Ploçk	352	217	135	77
Livonia	192	112	160	94
Minsk	1,325	537	216	97
Pskof	12	5	70	37
Lomza	2,563	1,287	75	38
Grodno	1,783	669	74	39
Tver	41	27	53	15

* The figures in this table have been kindly furnished to me by the Director of the Medical Department of the Russian Ministry of the Interior.

TABLE IV—*continued.*

Name of Government or Province.	1893.		1892.	
	Cases.	Deaths.	Cases.	Deaths.
Novgorod	13	11	17	12
Pietrkow	—	—	10	2
Vologda	4	3	10	4
Kaluga	276	148	29	19
Courland	2	2	7	3
Smolensk	117	48	5	4
Vilna	224	98	9	5
Vitebsk	3	3	2	2
Siedlec	257	137	1,791	953
Kovno	746	314	—	—
Kalisz	415	229	—	—
Suwalki	130	75	—	—
Esthonia	4	1	—	—
Total for European Russia	99,550	41,047	341,051	158,589
Daghestan	—	—	23,150	10,996
Terek	42	29	29,639	14,068
Stavropol	177	88	17,319	8,388
Kuban	946	600	34,078	18,560
Baku	154	86	21,690	12,644
Kars	48	35	2,928	1,369
Zakataly	—	—	991	598
Erivan	147	97	12,892	6,986
Elizavetpol	31	15	12,775	6,824
Tiflis	237	146	6,896	3,739
Kutais	183	107	609	318
Total for the Caucasus ...	1,965	1,203	162,967	84,490
Yeniseisk	—	—	223	76
Tobolsk	298	125	29,876	14,116
Tomsk	442	201	16,019	8,797
Akmolinsk	19	10	1,732	884
Transcaspia	—	—	2,800	1,517
Samarcand	—	—	16,402	8,201
Semipalatinsk	—	—	1,072	566
Semiretchinsk	—	—	46	28
Syr Daria	—	—	9,238	4,619
Turgai	—	—	296	166
Uralsk	22	13	6,596	3,293
Ferghana	—	—	12,925	9,833
Total for Siberia and Central Asiatic Russia .	781	349	97,225	52,096
Total for the whole Empire	102,296	42,599	601,243	295,175

ON CERTAIN AFFECTIONS OF THE MUCOUS SURFACES AND THEIR RELATION TO DIPHTHERIA.

By S. W. WHEATON, M.D.

(*Read: March 21st*, 1894.)

The subject upon which I wish to read a short paper this evening is one of great interest, but also of great difficulty. In our study of diphtheria we meet with it in two aspects, firstly as an endemic disease, and secondly as an epidemic disease. The prevalence of endemic diphtheria, at least in many towns and districts, does not appear to vary with the season of the year, contrary to what occurs in the case of epidemic diphtheria, the incidence of which is most marked in the autumn and winter months. Some authorities have gone so far as to say that the prevalence of diphtheria in an endemic form is always quite unaffected by the season of the year, but I am not aware that statistics are available which would show this to be true in the case of the country at large.

When we come to investigate the cause of epidemics of diphtheria, we find conditions at work the influence of some of which is more or less doubtful, such, for instance, as the influence of fluctuations of the level of the ground or subsoil water, unusually damp seasons, diseases of domestic animals, emanations from sewers; and others about the influence of which there can be no doubt, for instance, the consumption of infected food such as milk, the prevalence of sore-throat, and the gathering together of children suffering from sore-throat, especially at schools. It is with this sore-throat, and affections which I believe are closely allied to it, that I have to deal this evening. The mere presence of isolated cases of diphtheria in a district, or the attendance of children suffering from, or recovering from, diphtheria at school—a condition which most undoubtedly frequently obtains—does not appear to be sufficient to originate epidemic diphtheria; but some other contemporaneous conditions are required for the

development of an epidemic of this disease. I need hardly refer here, also, to the frequency with which diphtheria does not spread by infection, even among persons who would be regarded as susceptible; and the frequency with which prolonged exposure to infection, such as is seen in nurses and medical men, fails to originate the disease.

Of late we have had a steadily increasing amount of evidence to show that the condition which is by far the most frequent accompaniment of epidemic diphtheria consists in the prevalence of sore-throat. The frequency with which extensive prevalence of sore-throat has preceded or accompanied epidemics of diphtheria has led, on the one hand, to the idea brought forward by Dr. Thorne Thorne in his Milroy Lectures, "that there is reason to believe that attacks of so-called sore-throat exhibit under favouring conditions a progressive development of the property of infectiveness, culminating in a definite specific type which is indistinguishable from true diphtheria"; and, on the other hand, to the idea that these forms of sore-throat, which are without the physical characters of diphtheria, are yet due to the poison or virus of diphtheria, and are capable of communicating the disease to healthy individuals.

This relation between the gathering together of children suffering from sore-throat and the outbreak of epidemic diphtheria, appears to be comparable to the outbreak of epidemic ophthalmia which sometimes appears to be determined by the aggregation of children suffering from the affection of the eyes known as "granular lids"; and its explanation is equally difficult. Unfortunately, we have very little information concerning the physical characters of the forms of sore-throat which precede or accompany epidemic diphtheria, and this is, I think, due chiefly to the fact that a comprehensive inquiry into any given epidemic has usually been commenced either after the outbreak had come to an end, or at any rate when it was on the wane; so that opportunity is not afforded of making a comprehensive clinical report on the features of this sore-throat. The gathering of reports from local medical men respecting these affections is also of little value, since, owing to the trivial character of the sore-throat attacks, no notes of cases are kept, and such evidence would consist almost entirely of recollections, and therefore such reports would not be trustworthy. The subject is also of importance on account of its bearing on the question, whether under the provisions of the Infectious Disease Notification Act such

cases of sore-throat should be notified as diphtheria or not, and also to determine, if possible, whether persons suffering from these forms of sore-throat should be isolated from their fellows or not.

Having for several years kept this subject of the nature of these affections of the throat and their relation to diphtheria in view, I have taken every opportunity of making observations which might throw any light upon the question. In the beginning of November 1890, my attention was first drawn to a peculiar form of sore-throat, accompanied and followed by great debility, which at that time became very prevalent in South London, and which was in some instances accompanied by affections of other mucous surfaces. Since that date I have met with similar affections, which in some instances appeared to have connection with epidemic diphtheria, in others not; and I propose to give a short account of my experiences.

The district to which my first observations were more particularly confined was that extending on the south side of the river Thames from Battersea to Bermondsey. At that time, as physician to a dispensary, I was in the habit of seeing large numbers of people at their own homes; and also out-patients at the dispensary, and at a hospital the patients at which were drawn almost entirely from the same district. Since November 1890, I have noticed a continued prevalence of this sore-throat each year, and the period of prevalence has been almost entirely that extending from the beginning of November in one year to the end of May in the following year. I have had the opportunity of admitting several children suffering from this form of sore-throat into a hospital, in order the better to observe the course of the temperature and other characters of the affection. I have preserved notes of over thirty cases, and should estimate that at least 150 persons suffering from this affection have been under my care up to the present time.

In its clinical features this sore-throat is characterised in its early stages by a marked flushing of the face of the affected person. The face has also a swollen and puffy appearance, due to actual swelling of the subcutaneous tissue, especially that in the neighbourhood of the eyelids. There is also a general puffy swelling of the tissues of the neck behind the angles of the jaw in most cases; and in all instances marked enlargement of the glands of both sides of the neck in this situation, together with tenderness on pressure.

This swelling of the glands of the neck is one of the most marked features of the affection, and persists for a considerable time, in some instances at least for weeks after all other symptoms have disappeared. At the time when the patient presents the flushed appearance of the face, on examination of the throat there is found more or less swelling of the soft palate and fauces, with an increased secretion of mucus, which, especially in young children, is often present in large quantity on the back of the pharynx. Swelling of the tonsils is present also in some instances, but not invariably, and never to a marked degree. The most characteristic feature in the throat consists in the presence of bright red patches of injection; these patches are sharply defined, and most commonly present on the soft palate and fauces, in some instances extending all along the margin of the soft palate; they are much less commonly found on the surface of the tonsils. In the centre of these bright red patches of injection a white film or pellicle is found in the earliest stage of the affection, but this pellicle rapidly disappears, especially if any gargle is used for the throat; and in twenty-four to forty-eight hours it has generally completely disappeared. If the affection is watched from the first onset, it is seen that it begins with the formation of a white pellicle of this description surrounded by a bright red ring of injection, and from which as a centre the injected patch enlarges progressively for several days. This pellicle or film can be pulled off only with difficulty, because it has no defined edge, and is scarcely appreciably raised above the surrounding surface. On removal of this pellicle or film a red, slightly raw surface is left, which does not bleed. The film, on microscopical examination, is found to consist entirely of sodden, swollen, and opaque epithelial cells, and has none of the characters of diphtheritic membrane. When the white pellicle has disappeared, the red surfaces are seen to be studded with enlarged projecting mucous follicles, giving them a velvety appearance. At this stage of the affection the appearances closely resemble the red injected surfaces which remain for some time in the throat after the disappearance of the membrane in cases of undoubted diphtheria.

This affection of the throat is followed by prolonged anæmia and debility. The temperature is at first raised to 102 deg. or 103 deg., but becomes normal in the course of two or three days, and has no regular course. The pulse is quickened during the early stages of the affection,

and subsequently becomes feeble and irregular. No paralytic sequelæ have been observed in any instance, although the patients were under observation for from four to six weeks; but it must be mentioned that in three instances the patellæ reflexes were absent from the commencement of the illness, and continued absent as long as the patients were under observation, which was in one instance for a period of six weeks. Owing to the plantar reflexes being absent from the very commencement of the illness, and the absence of any further paralytic symptoms in these three instances, I am of opinion that these were not cases of slight diphtheritic paralysis, but were instances of persons in whom these reflexes were normally absent. No suppuration of the glands of the neck or other sequelæ were observed, nor did any case terminate fatally.

I have now to describe some affections of the mouth, nostrils, and vulva, which have also come under my observation, sometimes in association with the form of sore-throat above described in the same individual, sometimes without such association, or in members of a family some of whom were suffering from sore-throat.

These affections consist in the presence of white patches on the mucous membrane of the lips, nostrils, or vulva. These patches present a fairly well-defined margin; they are very slightly raised above the surrounding surface, and are surrounded by a bright ring of injection. A bright red injected surface remains after their disappearance, which occurs spontaneously in the course of two or three days. If these patches are pulled off they leave a raw surface, which bleeds readily. In the case of the nostrils and lips, the patches very often extend for some distance on to the neighbouring skin, and are accompanied by a slight enlargement of the corresponding lymphatic glands. When present in the nostrils, they can often be seen to extend backwards for some distance into the nares, and are accompanied by a thin ichorous discharge from the nose. On microscopical examination, the white patches are found to consist of sodden, swollen epithelium only, with a few blood corpuscles adhering to the surface by which they were attached to the mucous membrane. These patches were never present on the interior of the buccal mucous membrane, but in two instances were noted upon the tongue. In some instances this affection is present in one of the above-mentioned situations only, in others in two or more of these situations at the same time. Their mutual association with one another, and with the form of

sore-throat above described, together with the identical microscopical characters of the white pellicle, and the bacteriological evidence, which will be referred to later, all appear to show that these affections are identical with the affection noted in the throat, and are due to one common cause.

We come now to study the question of the nature of these affections. Are they a modified form of diphtheria or not, and if not, do they stand in any direct relation to diphtheria? The evidence for and against these views is in the first place epidemiological, and concerns their relationship when present in the form of epidemics; secondly clinical, thirdly pathological, and fourthly bacteriological.

With regard to the study of these affections from the epidemiological point of view, I have sometimes found them associated with epidemic diphtheria, sometimes not. I must, in the first place, say that I have not been able to trace any connection between these affections and diphtheria in London, apart from their seasonal prevalence, which coincides more or less with the seasonal prevalence of diphtheria in London. I have never been able to find any evidence of the presence of true diphtheria in families the members of which were suffering from these affections in London; but I need hardly refer to the extreme difficulty of carrying on any investigation of this kind in London, owing to the complexity of the factors at work.

However, in the year 1893, I was fortunate enough to have two excellent opportunities for investigating the subject. In the autumn of 1893 I was engaged in investigating an epidemic of diphtheria which was in progress in a town of between 9,000 and 10,000 inhabitants, in which at the time I commenced the inquiry it had already caused 28 deaths, and which also had invaded certain of the surrounding villages. On inquiry, I found in the case of the town, that the evidence pointing to the public elementary schools as the chief means of spread of diphtheria was almost irresistible. Out of 51 invaded households, in 44 instances, or 86 per cent., the first individual, and often the only person to be affected, was a child attending a public elementary school. I found that there was a great prevalence of sore-throat among children in the town, which had preceded and accompanied the outbreak of diphtheria. On examining into the clinical character of this form of sore-throat, then present in the town, I found it to be identical with that already described as prevalent in South

London, and that in some instances it was accompanied by affections of the lips and nose, exactly similar to those before mentioned; with the addition in many instances of nasal catarrh, in which no accompanying film or pellicle could be seen at the time of examination. On inquiry, I found that the affections which had preceded the outbreak of diphtheria had exactly resembled those which were then present among the children in the town. I had the opportunity of examining the children in all the public elementary schools of the town, and found that these affections were prevalent among the children actually at school at the time, but were almost entirely confined to the younger children. Children suffering from the before-described form of sore-throat were found in all the schools; and in all except one, children presenting white patches at the margins of the mouth or nostrils were found also. To show, for example, the extreme prevalence of these affections, I may say that among 144 children in one schoolroom I found 20 suffering from the above-described form of sore-throat; and in the same school, several children presented white patches in the neighbourhood of the mouth or nose, similar in their character to those already described. On inquiry at the houses in the town, I found several instances where children were suffering from these affections who were below the school age, and where no member of the family went to school, and among which no attack of diphtheria had occurred. I also found that the younger children at a public institution presented these affections to a marked extent, although no attack of diphtheria had occurred in the institution. Now, on inquiring into the surroundings of these children in this institution, I found that none of them went to school in the town, but all attended a country school some distance away, and never mixed with the town children. On visiting this country school, I found the children attending there at the time were entirely free from these affections, and also that no attack of diphtheria had occurred among them or in the village.

The country district surrounding the town included nine villages, at which there were public elementary schools. Diphtheria occurred in epidemic form in two only of these villages. I had the opportunity of examining the children in the schools of all the nine villages, and found that, with one exception, the children attending school in those villages in which epidemic diphtheria had been absent were free from any affections similar to those already described. The children in the schools in those villages in which epi-

demic diphtheria was present were, however, suffering from these affections to a large extent, and they were present to a limited extent among the children at school in a village in which diphtheria was not known to be present.

In the spring of the year 1893 I was concerned in the investigation of an outbreak of diphtheria which occurred in three small wards in a children's hospital, which were all on the same floor, and directly continuous with one another, so that they formed practically one ward. With the exception of one case, the outbreak, which caused eight deaths, was entirely limited to these wards. On investigating the condition of the children in the wards of the hospital, I found that in these three wards in which diphtheria had occurred many children were suffering from affections of the throat and nose identical with those before described, but the children in the other wards of the hospital were entirely free from these affections. There was, however, no evidence that these affections had preceded the outbreak of diphtheria, but that they were contemporaneous with it there was no doubt.

In 1891, whilst in charge of a lying-in hospital, I observed a limited outbreak of an affection, consisting in the development of small, yellowish white patches surrounded by an inflamed area on the vulva of lying-in women after delivery. The affection was altogether trivial; in some instances a slight elevation of temperature was the only additional symptom, and no diphtheria nor sore-throat preceded or accompanied it, nor did any paralytic symptoms follow; in short, all the indications of diphtheria were absent. In the same year, Messrs. Ehrhart and Favre published, in the *Nouvelles Archives d'Obstétrique et de Gynécologie*, under the heading of "Clinical and Bacteriological Researches on an Epidemic of Benign Puerperal Diphtheria at the Paris Maternité", an account of an outbreak at the Paris Maternité, which appears to have been of a similar nature, and was entirely devoid of any semblance to diphtheria, except in so far as a greyish-yellow irregular membranous exudation appeared on the vulva in 33 lying-in women in less than three weeks, and in one infant only a patch of membrane appeared in one eye. The affection was altogether trivial, and had no tendency to a fatal termination, nor was it known to be followed by any paralysis. No account is given of the microscopical examination of the membrane, but extensive cultivation and inoculation experiments were made, as the result of which it was found that a great number of micro-

cocci were present in the membrane, and also a bacillus which had some resemblance to the bacillus diphtheriæ, but which could not be permanently cultivated. It appears to me, therefore, and it is practically admitted by the authors, that the diphtheritic nature of this outbreak was not proved.

Lastly, I must add that I have, in several instances, seen these affections of the throat, mouth, or nose precede by a few days the onset of undoubted diphtheria.

On reviewing the foregoing observations, it will be seen that these affections have sometimes accompanied epidemic diphtheria, and at other times they have prevailed apart from diphtheria altogether. In the case of the town before referred to, it is to be noted that these affections preceded epidemic diphtheria, that they existed in the public institution, and among families no members of which were attending school, and among which diphtheria had not occurred, but that the connecting link between these affections and diphtheria appeared to be attendance at public elementary schools, at which schools I may state that there was abundant opportunity for the spread of contagion of diphtheria through the medium of children returning to school convalescent from diphtheria, or in clothes which had been worn whilst suffering from diphtheria; or by children attending school from households members of which were at the time suffering from diphtheria.

Clinically it will have been seen from the foregoing account that the affections above described have some resemblance to diphtheria, inasmuch as a white pellicle or film is present, accompanied by glandular enlargement and heightened temperature. The fleeting character of this pellicular formation, its entire disappearance occurring in the course of two or three days at the most, and the absence of any paralytic sequelæ, are features which distinguish these affections from diphtheria. In no instance have I seen any indication of extension to the respiratory tract, or albuminuria, or any tendency to a fatal termination.

From the pathological point of view these affections are distinguished from diphtheria by the characters of the film or pellicle which is present on the mucous membrane of the throat, lips, nose, or vulva, which has none of the characters of the fibrinous exudation composing the false membrane of diphtheria, but consists entirely of swollen and opaque epithelium cells. With regard to the pathological changes in the cervical glands, and the possibility of changes in other organs of the body, I have, of course, no information, owing to the non-fatality of the affections.

The bacteriological evidence that I am able to bring forward has been directed almost entirely to ascertaining whether these affections were diphtheria or no, and has been so far entirely of a negative character. Cover-glass preparations of the film or pellicle removed from the throat or other parts, and of the secretions of the throat in the vicinity of the red patches, have shown the presence of large numbers of micro-organisms, chiefly cocci. These cocci were present either singly or in pairs, or in the form of dense colonies embedded in a structureless material. The affection was found not to be due to the presence of the "thrush" fungus, or to any other form of fungus. No organisms resembling the bacillus diphtheriæ were ever found present in sufficient numbers to justify the opinion that the affection was diphtheria. Cultivation experiments entirely failed to produce any organism resembling the bacillus diphtheriæ, but a micro-coccus growing in orange-yellow colonies was always obtained, sometimes in pure culture. With regard to the pathogenic properties of this micro-coccus, I have not made any investigations. It is well known that many observers have stated that they were unable to obtain an organism having the characters of the bacillus diphtheriæ from cases of diphtheria, but they have obtained a micro-coccus.

At this point I may be permitted to refer to one of the latest reports from one of these observers who have failed to find the bacillus diphtheriæ; this report is by Dr. Albert Wilson, and is contained in the *Transactions of the Pathological Society of London for* 1891. As the result of extensive cultivation and inoculation experiments made during an outbreak of diphtheria, he failed to obtain any specific organism from the true diphtheritic membrane; but from a thin grey exudation, which in the epidemic preceded the formation of membrane, he obtained a micro-coccus growing as small orange-coloured patches on gelatine at a temperature of 60° F. With this micro-coccus he claims to have produced true diphtheria in pigeons, both by inoculation of scratches on the mucous membrane of the throat and by hypodermic injection. He especially says that the micro-coccus is found only in a milky-grey transparent exudation forming on the swollen mucous membrane of the throat, which in a few cases he has watched to precede the formation of diphtheritic membrane; and he states that "I attach the highest importance to this early exudation as being the only true hunting-ground for the organism of diphtheria". It appears to me to be

extremely probable that Dr. Wilson was here dealing with an epidemic of diphtheria which was accompanied by affections of the throat such as I have described, and that his bacteriological conclusions were really made upon the examination of the film or pellicle which I have before drawn attention to as preceding the invasion of diphtheria in some instances, and which may exist in the form of an affection entirely separate from diphtheria.

To summarise these foregoing observations, it would appear that the clinical, pathological, and bacteriological evidence which I have been able to bring forward tends to show that these affections are not diphtheria, nor a mild or modified form of diphtheria. The evidence derived from their study from an epidemiological point of view indicates that these affections may prevail apart from diphtheria, and under circumstances in which their origin by infection from diphtheria is negatived. On the other hand, it appears that in outbreaks of epidemic diphtheria these affections may, and do, sometimes accompany and precede the epidemic, and it appears probable that the prevalence of these affections has a large share in determining the outbreak of diphtheria in an epidemic form in some instances. The way in which these affections act is probably by creating a lesion of the mucous surfaces by which the virus of diphtheria obtains entry; or, on the other hand, it is probable that there may be a condition of commensualism in these two affections, and that epidemic diphtheria may be likened to a lichen in the vegetable kingdom, which consists of a fungus parasitic upon an alga, the alga being represented by the thin film or pellicle existing in these affections, and upon which the more powerful and predominating virus of diphtheria becomes, like the fungus, grafted, and flourishes. If this is the case, the contradictory conclusions of bacteriologists who have investigated diphtheria may be perhaps explained.

I do not think that the evidence which I have brought forward this evening is by any means conclusive. The subject is one of the greatest complexity, and I have only touched upon the fringe of it; still, the object of my paper will be served if it succeeds in directing attention to the importance of a comprehensive study of the features of the sore-throat and allied affections which accompany epidemic diphtheria, and if it elicits the experience of others, who have had larger opportunities than myself, concerning the nature of these affections.

ON THE

CO-EXISTENCE, OR THE OCCURRENCE IN CLOSE SUCCESSION, OF MORE THAN ONE INFECTIOUS DISEASE IN THE SAME INDIVIDUAL.

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(*Read: April 18th*, 1894.)

Some time back, in response to an invitation from your secretaries, I expressed my willingness to contribute a paper on some subject bearing on infectious disease, or the work in infectious disease hospitals. I afterwards experienced the usual difficulty of making up one's mind as to what particular theme would form a satisfactory basis for discussion. I was induced to take the subject which forms the title of this paper, chiefly because it is one on which my experience would allow me to address you with some assurance, and also because it may be expected to possess some interest for the Epidemiologist, although the evidences which I propose to lay before you are almost entirely drawn from clinical practice.

Now although the fact was without doubt fully recognised by Murchison, that instances of the concurrence of more than one infectious disease in the body were not uncommon, yet there seems to exist, even at the present day, a curiously widespread belief that such co-existence, at any rate if not impossible, is not a matter of common occurrence.

This belief, in all probability, owes its existence to the teaching of John Hunter, in whose Lectures on the Principles of Surgery, under the heading "All Diseased Actions are Simple", there occurs the definite statement that no two diseases are capable of existing together in the human body. He, however, seems to have admitted that the potentiality of a second disease may exist during the manifestation of another.

If one may judge from the number of cases which are

reported from time to time in the medical journals, it seems to be regarded as a distinctly exceptional event. Indeed, Murchison, in 1859, when reporting a list of cases, states that "the prevalent opinion, however, is opposed to the doctrine of the possibility of co-existence." In the course of conversation I have been frequently impressed with the truth of this remark, and it is in the endeavour to assist in controverting this belief that I desire to claim your attention this evening. During the course of nearly seven years spent in the study of infectious disease, I have met with many instances of such co-existence.

On referring to the records of the Stockwell Fever Hospital for the last four years, I find 362 cases in which the attack of one infectious disease was complicated by the appearance of a second. In addition to these there occurred 17 cases which were marked by the incidence of no less than three diseases in the same individual.

In a certain proportion of these cases the second disease arose during the late convalescent stage of the primary attack, but in exactly 200 of them the two diseases either ran concurrently, or the second one was contracted at some time before the febrile stage of the first had terminated.

On a detailed examination of these 362 cases it appears that:—

In 197 *Scarlet Fever* was the primary disease, in 97 of which the attack was complicated with diphtheria; in 43 with chicken-pox; in 31 with measles; in 13 with whooping-cough; in 10 with erysipelas; in 2 with enteric fever; in 1 with typhus fever.

In 97 *Diphtheria* was the primary disease, in 88 of which the attack was complicated with scarlet fever; in 1 with chicken-pox; in 2 with measles; in 6 with whooping-cough.

In 23 *Chicken-Pox* was the primary disease, in 20 of which the attack was complicated with scarlet fever; in 2 with diphtheria; in 1 with measles.

In 18 *Measles* was the primary disease, in 9 of which the attack was complicated with scarlet fever; in 2 with chicken-pox; in 7 with diphtheria.

In 17 *Whooping-Cough* was the primary disease, in 14 of which the attack was complicated with scarlet fever; in 3 with diphtheria.

In 9 *Enteric Fever* was the primary affection, in 6 of which the attack was complicated with scarlet fever; in 3 with diphtheria.

In 1 *Typhus Fever* was the primary disease. In this case the attack was complicated with scarlet fever.

In those cases in which three diseases were observed in the same patient, either concurrently or in close succession, the notes shew that the order of appearance of the separate diseases was in the following sequence:—

Scarlet fever	...	Measles	...	Chicken-pox	...	in 3	cases.
„	...	Chicken-pox	...	Measles	...	„ 2	„
„	...	Diphtheria	...	Measles	...	„ 1	case.
„	...	Whooping-cough	...	Measles	..	„ 1	„
„	...	Rötheln	...	Chicken-pox	...	„ 1	„
„	...	Enteric fever	...	Diphtheria	...	„ 1	„
„	...	Whooping-cough	...	Diphtheria	...	„ 1	„
„	...	Diphtheria	...	Rötheln	..	„ 1	„
„	...	Diphtheria	...	Erysipelas	..	„ 1	„
Chicken-pox	...	Erysipelas	...	Diphtheria	..	„ 1	„
„	...	Diphtheria	...	Scarlatina	...	„ 1	„
Measles	...	Scarlet fever	...	Diphtheria	...	„ 1	„
Diphtheria	...	Whooping-cough	...	Scarlet fever	...	„ 1	„
Whooping-cough	...	Diphtheria	...	Scarlet fever	...	„ 1	„

In 3 of the above cases each of the intercurrent diseases was contracted during the convalescent stage of the preceeding one; in 11, one of the intercurrent diseases was contracted during the convalescent stage, and one during the acute stage of the preceding one; in 3, each of the intercurrent diseases was contracted during the acute stage of the preceding one, and in two of these the symptoms of all three diseases were present at the same time.

For the purpose of deciding which disease in the above records should be regarded as the primary one, I have taken the day on which the affection was probably *contracted*, and, in order to arrive at this date, the average incubation period for the disease in question has been subtracted from the day on which the symptoms first appeared.

In endeavouring to calculate the probable date of infection by this method, the coincidence in some cases appeared to be so close that it was difficult to decide as to which disease should more properly be considered the primary one. The method, however, though open to this objection in some cases, would seem to be of more value in arriving at an inference of relative susceptibility than one in which the priority of disease is decided by simply noting the dates on which the symptoms appeared.

Admitting the fact that more than one infectious disease is not infrequently seen to be co-existent in the same individual, it will be interesting to inquire:—

1. Whether the relative susceptibility of the individual in respect to any particular disease is influenced by the presence of any other in particular.

2. In what direction, if any, the course of one disease is modified by the presence of another.

Now with reference to relative susceptibility, any inference drawn from the foregoing figures is greatly vitiated by the fact that the liability to contract a second disease is necessarily influenced by the accidental chances of exposure to its particular infection, and, therefore, to draw even the broadest induction, it is necessary that it should be based upon an examination of the largest number of cases which are available.

Scarlet Fever.

On examining the records of the scarlet-fever cases admitted into the Asylums Board Hospitals for the last six years, it will be found that the admissions for that period numbered 48,367. Of these, 3,166, or 6.54 per cent., were complicated either during the febrile stage or during convalescence by the appearance of a second infectious disease. In 1,094 the secondary disease was diphtheria; in 899, chicken-pox; in 703, measles; in 404, whooping-cough; in 55, erysipelas; in 11, enteric fever; in 1, typhus.

Thus in by far the greater number of cases the complicating disease was either diphtheria, chicken-pox, measles, or whooping-cough. When we remember the high degree of infectivity possessed by the three latter affections, whether prevalent in the overcrowded homes of the poorer classes, the school, or in a hospital, and their proneness to spread even in a well-appointed children's ward devoted to the treatment of any class of disease if once they gain an entrance, it is evident that the objection which I have already stated, to drawing an inference of relative susceptibility from the simple fact of their occurrence, is especially applicable.

The liability to diphtheria, it should be remembered, is greatly increased by the fact that one attack of that disease affords little or no protection against its subsequent development, whereas measles, chicken-pox, and whooping-cough (especially the two latter) are all of them highly protective against a second attack.

The comparatively small incidence of whooping-cough in the scarlet-fever cases, though one of the commonest diseases of childhood, is probably to some extent influenced by the fact that whooping-cough is mainly a disease of earlier life than is the case with scarlet fever. It is seen most frequently in the second and third year, whereas the

greatest liability to scarlet fever occurs in the fifth and sixth years of life. This is confirmed by an analysis of the age admissions of 72,000 consecutive cases of scarlet fever received into the Asylums Board Hospitals. Therefore, then, remembering that one attack of whooping-cough confers almost absolute immunity against itself, it is only reasonable to assume that a large proportion of scarlet-fever patients are insusceptible to whooping-cough, having previously suffered from the disease.

That in only eleven instances was scarlet fever complicated with enteric fever, is probably mainly dependent on the fact that the liability to that disease, in contrast with whooping-cough, is greatest at a more advanced age than obtained in the large proportion of the scarlet-fever admissions. Beyond which, patients treated in a properly constructed and carefully administered hospital are not likely to be subjected to the contagion of enteric fever.

There is little doubt that most of these cases were infected with enteric fever before admission.

That scarlet-fever patients should evince a special liability to the development of diphtheria is only what might be expected from an examination of the recent evidence drawn from the field of bacteriology. The bacillus of diphtheria, owing to the patient research of Klebs and Löffler, and the later excellent work of Roux, Yersin, and Fraenkel, to say nothing of that conducted by various observers in our own country, can now be usually demonstrated in cases of true diphtheria. The organism can be cultivated with ease in suitable media outside the body, and it is readily inoculable on an abraded or otherwise damaged mucous membrane.

In the ulcerated or inflamed faucial mucous membrane of a patient suffering from scarlet fever, or on that already weakened by a recent attack, the bacillus meets with the very conditions of soil and environment most favourable to its growth, and it is no matter for surprise that under conditions so favourable to infection, an attack of diphtheria should be the result.

The bacillus is usually found associated, even in cases of pure diphtheria, with the streptococcus identical with that present in suppurative processes. In the ulcerated throat of either scarlet fever or simple tonsillitis, this streptococcus being invariably present, would seem to prepare the soil for the development of the diphtheritic bacillus. In cases of scarlet fever in which diphtheria is the superadded disease, both bacillus and streptococcus can almost invariably be demonstrated, there being, according to Roux, a very dis-

tinct relation between the number of bacilli present and the toxic intensity of the attack in an early stage, although this statement is by no means always confirmed by observation. At a later stage, the membrane when undergoing disorganisation is found to be mainly crowded with septic organisms, chief of which may be enumerated the staphylococci, streptococcus pyogenes, bacterium termo, leptothrix buccalis, and many vibriones.

The septic saprophytes are rarely found in any number in the membranes so rapidly formed and coughed up from the larynx and trachea, though Löffler's bacillus may usually be demonstrated in them. The special liability of the scarlet-fever patients then to the development of diphtheria, even in the convalescent stage, is not only a matter of clinical observation, but is also supported by bacteriological inference.

That there is a liability in scarlet-fever patients to the development of *chicken-pox* and *measles* is also shewn by the foregoing figures; but whether the susceptibility of those suffering from scarlet fever is greater than it is in those who are the victims of, or who are recently convalescent from, other forms of acute disease, is at least doubtful, when we remember the great infectivity of these two affections. Nor must the fact be overlooked that the chance of taking any infection is increased by a condition of diminished vital resistance in the subject, however this may have been produced.

Speaking generally from my own experience, I should regard the susceptibility to both chicken-pox and measles as being about equal.

That the subjects of scarlet fever are susceptible to *whooping-cough* is shewn by the figures I have already quoted; and there is little doubt, if the age incidence in the two diseases were more in agreement, that many more instances would have to be recorded, as an immunity from whooping-cough would not have been so frequently acquired previously to the attack of scarlet fever.

The liability of scarlet-fever patients to *enteric fever* cannot be great, as is shewn by the fact that only eleven instances are recorded amongst the 48,367 cases to which I have referred. This is supported by a statement of Murchison's, that in the course of twenty-three years' experience at the London Fever Hospital, at a time, too, when all classes of disease were treated together in the same wards, and many thousand cases of scarlet fever were admitted, not more than eight instances were recorded in

which scarlet fever and enteric were co-existent. Beyond which, it must be remembered that both scarlet fever and enteric are mainly prevalent at the same time of year, viz., the autumn and early winter. This would undoubtedly increase the chance of their occasional co-existence, should there be any special liability in that respect.

That scarlet fever may be followed by, or exist along with *typhus*, is also a recorded fact. At the present day, owing to the rarity of typhus fever in London, we do not get much opportunity of observing its character even apart from other disease. Murchison, however, in the near past, records seven cases in which scarlet fever was complicated with typhus. In two of them it appeared on the third day, when the cuticle was already desquamating.

About two years ago I lost a child aged eight, in whom typhus appeared on the third day of a typical attack of scarlet fever, before the rash had completely disappeared. In this case it is most probable that the typhus was contracted before the scarlet fever, but the latter disease, owing to its shorter incubation period, was the first to show distinctive signs of its presence.

As in the case of enteric fever and typhus, there seems to be no reason to assume any special liability to develop *erysipelas* on the part of the scarlatinal patient. Of the nine cases which I have personally treated during the last four years, the notes show that in seven of them the erysipelas appeared before the scarlatinal temperature had reached the normal. I have but very rarely observed its appearance after the operations occasionally performed in the scarlet-fever wards.

There is no reason to believe that *small-pox* is particularly prone to appear in scarlatinal patients, although instances of their presence in close succession are occasionally met with. It is quite possible, however, that some of the profuse initial rashes which have been observed in certain cases of small-pox may have been really instances in which the two diseases were co-existent.

In turning from the consideration of those instances in which scarlet fever was the primary disease to those in which some other infectious disease was first in the field, and in an endeavour to draw an inference as to the relative susceptibility evinced towards the development of any particular second, I am to some extent handicapped in that I have not the same amount of material at my disposal. This will be obvious when it is stated that over 75 per cent. of the admissions into the public fever-hospitals consist of

scarlet fever. For which reason I shall not attempt in the same degree to rely on the four years' record of any particular hospital, or even on the wider generalisation to be drawn from the incidence amongst a large number of cases, but rather by referring to the experience gained in the course of clinical practice to convey to you what seem to be the most trustworthy evidences.

Diphtheria.

As we have already seen in the case of scarlet fever that there is a special liability to the development of diphtheria, so, too, when diphtheria is the primary disease, is there a corresponding liability to the occurrence of *scarlet fever*. There would seem to be a co-related susceptibility between them. In the records of the Stockwell Fever Hospital, before referred to, I may state that out of 97 cases in which diphtheria was the primary disease, in 88 of them scarlet fever was found as its close attendant. The susceptibility of diphtheria patients to scarlet fever, however, does not seem to be so great as in the converse instance, but that it is a distinct fact has frequently been forced upon my conviction. It is worthy of remark that when scarlet fever occurs during convalescence from diphtheria, it is apt to be attended with a reappearance of the pellicular formation on the tonsils. which may even extend to the neighbouring structures. To this I shall refer later.

That scarlet fever but rarely arises in hospital, except in connection with a previous case, which is usually recognised sooner or later, has an important bearing on the patient's chance of becoming its victim. The fact is that we are generally able to protect a diphtheria patient from exposure to its infection, and so he does not often contract it. But should a case once gain admission into a diphtheria ward, its incidence amongst the patients is probably greater than it would be among those suffering from any other form of disease, with the possible exception of measles. The fact of their peculiar liability is then usually apparent. Why diphtheria patients should be especially liable is at least doubtful, but the fact that in both diseases the throat is the seat of the most obvious specific lesion, is at least suggestive of its having become a weak point as a result of the previous disease, and therefore more susceptible of a local infection.

The susceptibility of diphtheria patients to the development of scarlet fever would seem to lend some confirma-

tion to the view that the throat is the part at which the infection of scarlet fever is received.

In endeavouring to arrive at an explanation of the development of diphtheria we are greatly assisted by our knowledge of the conditions of soil and environment under which it may be expected to thrive. The bacteriology of scarlet fever at present, however, is, unfortunately, a pure matter of speculation, notwithstanding the free and easy way in which the "bacillus of scarlet fever" and its comparative power of resistance is so frequently quoted in evidence of the superlative superiority of some of the much vaunted and widely advertised patent disinfectants. The fact, however, that in so many cases a sore-throat has preceded by several days, even a week, the symptoms of the scarlatinal attack, and also that in the infectious sore-throats occasionally seen in well-seasoned scarlet-fever attendants, the faucial affection appears to be the only obvious symptom, would certainly seem to suggest that the fauces are the seat of inoculation, and constitute a nidus from which in a short time the system may become secondarily invaded.

This, however, is purely conjectural, and there is something to be said on the other side.

For instance, it may be objected that in some cases of scarlet fever there is no sore-throat, that in the essentially toxic attacks there is no relation between the severity of the throat lesion and the gravity of the attack, and that patients suffering from many and various forms of surgical illness are extremely prone to take the infection of scarlet fever.

I am not aware of any very special susceptibility in diphtheria patients in respect to any other particular disease, although I have met with cases which have been complicated with measles, chicken-pox, whooping-cough, erysipelas, mumps, and influenza. Next to scarlet fever, I should regard measles as being, perhaps, the disease to which diphtheria patients are most liable.

Measles.

Patients primarily affected with measles are very prone to the development of *diphtheria*, *whooping-cough*, and *scarlet fever*. I have seen one case in which all four diseases existed together, the only doubtful one being diphtheria, as it was not then possible to apply the bacteriological test by way of confirmation.

The explanation of the great liability of measles patients to the development of diphtheria is probably the same as that already given in reference to its occurrence after scarlet fever, namely, a weakened condition of the mucous membrane of the fauces and respiratory tract, consequent on the attack of measles. When measles is followed by diphtheria there is a great tendency to an early, if not primary, affection of the larynx and trachea, and I take this as evidence in the same direction.

The liability to contract whooping-cough during the attack or convalescence from measles is only what might be expected in view of the fact that the susceptibility to both diseases is greatly increased by the presence of broncho-laryngeal catarrh.

The age incidence of measles and scarlet fever is very nearly in agreement, that of the former being probably somewhat lower than that of scarlet fever. When the two diseases are coexistent in the same subject, and the symptoms of both are present at the same time, it must be remembered that the measles was without doubt contracted at an earlier date than its fellow, having regard to its longer incubation period.

I have already referred to one case in which scarlet fever, diphtheria, and measles were all coexistent in the same individual. In this case the measles and diphtheria were probably contracted nearly simultaneously, five or six days after the reception of the scarlatinal virus.

Chicken-Pox.

That the subjects of varicella are often attacked with the various infectious diseases common to childhood is a matter of frequent observation. Cases of *scarlet fever, diphtheria,* and *measles* are often admitted with the signs of recent varicella in the vesicular or pustular stage, or showing the pigmentary discoloration which remains for a time after the scabs have separated.

There is no evidence that chicken-pox especially predisposes to the occurrence of any particular form of disease, and, having regard to the mildness of its constitutional disturbance, this is no matter for surprise.

Small-Pox.

Certain cases of small-pox are said to be complicated by an affection of the fauces and larynx which are clinically indistinguishable from *diphtheria,* but not having met with

any in my own practice, I am unable to speak definitely as to their real nature. They are certainly not common, and any doubt as to their true character should be capable of settlement if examined by the bacteriological test.

It is quite possible that some of the cases of small-pox in which initial punctate, erythematous, or macular rashes have been described as not conforming, in situation or extent to that usually met with in that disease, were in reality cases of small-pox in which an attack of either *scarlet fever* or *measles* was running concurrently. It is generally recognised, at any rate, that *erysipelas* is a common complication of confluent small-pox.

Enteric Fever.

In this disease there seems to be no special liability to the development of any second disease in particular. Murchison records cases in which *scarlatina*, *diphtheria*, *small-pox*, and *whooping-cough* were met with during the course of enteric fever. I can certainly recall ten such instances, six of scarlet fever, two of diphtheria, one of whooping-cough, and one of measles. They are not often met with, but cases in point have been recorded by Taupin, Forget, and Peacock.

Typhus Fever.

The subjects of typhus, though not exempt from a liability to the development of other infectious diseases, are but rarely affected, as in the case of enteric fever. Murchison records four cases in which typhus was followed within a fortnight by *scarlet fever*, but he had not seen their actual co-existence. In my own case, to which I have already referred, the two diseases ran concurrently, and although the symptoms of scarlet fever appeared first, there is little doubt but that the typhus was contracted several days earlier.

Murchison and Gairdner both mention several cases of typhus followed by *diphtheria*, and Murchison, too, records cases in which the complicating disease was *enteric fever*. Barallier instances several cases in which typhus was co-existent with *small-pox*. This also had been observed at the London Fever Hospital.

So much, then, for relative susceptibility.

2. Now with reference to the question whether the course of one disease is influenced in any way by the pre-

sence of another in the body, inquiries would chiefly seem to be indicated in the direction of (*a*) the period of incubation; (*b*) the symptoms and severity of the different affections. As regards the period of incubation, I may state at once that I have never seen anything to warrant the assumption of an interference with the length of incubation usually observed in connection with any particular disease.

The latent period of all diseases, even when uncomplicated by the presence of another, is subject to variations which are more marked in the case of some affections than it is in others. In order of constancy of their period of incubation, I should place them provisionally in the following succession:—First, small-pox, chicken-pox, measles, and whooping-cough; then scarlet fever and German measles; and lastly, diphtheria, typhus, mumps, and enteric.

Just as the latent stage in independent chicken-pox is more constant than it is in independent attacks of diphtheria, so would it seem to be when either of them occurs as a complication of some previous disease. A primary vaccination runs precisely the same course in a scarlatinal child as it does in a healthy infant; or, to borrow an example from bacteriology, just as the bacillus of diphtheria will grow side by side with the *streptococcus pyogenes* in a tube of blood serum so long as there is sufficient soil for them both to feed on, so should we expect the various organisms concerned in the production of human disease to increase and multiply concurrently in the comparatively vast expanse of the human economy.

The deterring influence of putrefactive organisms on the development of certain facultative parasites growing under aerobic conditions is acknowledged, but I cannot call to mind any instance which justifies the belief that any such inhibitory power can be exercised by one pathogenic organism on the development of another while under the anaerobic condition which is a feature of their life within the body. I am willing to admit, however, that this may be simply an expression of ignorance on my part.

(*b*) With reference to the clinical signs of any two diseases which may either co-exist or occur in close succession, it may be stated generally that the presence of one disease does not delay the appearance or usually tend to suppress the symptoms of the other. On the contrary, the symptoms of both are mingled in the individual, and

are often marked by a degree of intensity unusual in uncomplicated attacks.

This is much more marked in the case of a disease arising together with, or closely following, another which by its natural severity has made a greater call on the vital resistance of the patient. Thus, scarlet fever arising during the course of a mild disease such as chicken-pox is not usually marked by anything like the same comparative degree of intensity as is seen in many cases of chicken-pox when it complicates the attack of a relatively important disease, such as scarlet fever.

I had under my care some time back two brothers, one of whom during an attack of chicken-pox developed an attack of scarlet fever, which proved to be very mild. His brother, on the contrary, at the end of the first week of scarlet fever, when the rash was just disappearing, developed an attack of chicken-pox, which for extent of rash and severity of constitutional disturbance I have never seen surpassed. He was covered with the most copious eruption from the crown of his head to the soles of his feet, and his temperature for four days varied between 105° and 102°.

Each boy contracted his second disease from his brother, exemplifying the principle of give and take so desirable in all families, but in the latter case, the boy having recently suffered from a naturally severe disease, viz., scarlet fever, received a good deal more than he gave to his more fortunate brother, who had been previously the victim of that mildest of diseases, varicella.

This case is but an instance of a general rule, for the attacks which we so frequently see of varicella, following on a well-developed attack of scarlet fever, are, on the average, of a more severe type than those which are unconnected with any previous disease. To all rules, however, there are marked exceptions.

When chicken-pox as the primary disease is followed by measles, scarlet fever, diphtheria, or whooping-cough, the superadded disease seems to be in no way modified in its course. The distinctive features of such diseases are simply mingled with either the vesicles or scabs of chicken-pox, according to the stage of that malady at which they have arisen. I have never seen chicken-pox closely followed by either typhus, enteric, or small-pox, but there is no reason to expect that there would be any modification of their normal course.

I have the notes of a case in which a child six years old,

towards the end of the third week of scarlet fever developed a severe attack of measles. This was followed on the fourth day of the rash, when the lachrymation and catarrh were still present, and the temperature had just dropped to 99°, by the appearance of a most copious varicella eruption and a rise of temperature to 101°. In this case the eruptions of measles and varicella were intermingled with the characteristic desquamation of scarlet fever. The child was probably infected with measles at the end of the first week of scarlet fever, and after three or four days took the infection of chicken-pox to which it had been exposed in the ward fourteen days before the eruption appeared.

When scarlet fever is the primary disease, and is complicated with diphtheria, the greatest care must be taken in recording such cases to eliminate those instances in which the tonsils are coated with an exudation very similar in appearance to that seen in the early stage, or in a mild attack, of true diphtheria. Such a case may very readily be confounded with one in which the two diseases are really co-existent.

The fact that a membranous pellicle is not rarely seen on the tonsils in uncomplicated scarlet fever seems not to be so generally recognised as the frequency of its occurrence would warrant, if one may judge from the number of cases of scarlet fever bearing this appearance which are sent up to hospital with the diagnosis of diphtheria.

This condition was recognised in Germany some years ago, and was described, I believe, first by Professor Henoch of Berlin under the name of Scharlach Nékrose. In these cases the exudation is usually seen for a day or two on the tonsils during the height of the very intense faucial inflammation which is present in some cases of scarlet fever. The pellicle is usually only slightly adherent, and does not reach the same degree of thickness as it does in most cases of pure diphtheria, which are characterised by a local process of any intensity. On a microscopical examination both streptococci and staphylococci are to be found in abundance, but not the bacillus of Löffler. I quite admit that some cases are difficult to distinguish from true diphtheria.

A characteristic feature of these cases is that the exudation is quickly replaced by a superficial ulceration of dirty white appearance and a woolly surface, between which and a true exudation it is very difficult to distinguish. In very severe cases this necrotic process extends both in depth and

extent, and may ultimately lead to destruction of the faucial arch.

When scarlet fever is complicated with undoubted diphtheria the affection most frequently arises at a later stage of the scarlatinal illness, although in many cases the two diseases are practically coincident.

The exudation in these cases bears no definite relation to the degree of tonsillitis present. From the tonsils it usually extends on to the neighbouring parts, and very frequently in young children affects the larynx and trachea, or, extending to the nasal fossæ, it gives rise to a profuse irritating discharge which is of very unfavourable omen.

The mortality among such cases is very high. In one series of 52 cases, 22 died. In another series of 11 cases, 10 died. It is especially dangerous when the larynx is involved, and should the patient live long enough, paralytic sequelæ are often observed.

One of the most severe cases of diphtheritic paralysis of peripheral distribution that I have ever seen occurred in a child six years of age, who developed diphtheria during convalescence from an attack of scarlet fever. Another died from cardiac failure in the third week of convalescence from the two diseases. The scarlatinal rash in these cases, should it still remain when the diphtheria arises, usually becomes intense, and often has a tendency to develop a staining character.

The following case is a good illustration of the dual attack:—T. S., aged five. In this child the two diseases were running hand in hand, and the diphtheritic affection of the fauces was very severe. The scarlatinal rash, which remained visible until the tenth day, became very dark, and was early followed by most profuse desquamation. The tongue cleaned up on the fourth day in a manner typically scarlatinal, despite the fact that the faucial exudation remained excessive. Great rapidity of pulse and a subnormal temperature set in three days before death, which took place on the sixteenth day from well-marked cardiac paralysis.

When diphtheria in the acute stage is complicated with scarlet fever the gravity of the condition is much the same, and when it is followed at a later stage by scarlet fever, the condition, though it may be serious, is not usually so grave as when the order of incidence is reversed. In this instance the scarlatinal attack for the most part runs the usual course. The symptoms are well developed, but are often more severe than in the average

independent attack, and I think there is a greater tendency to nephritis; but it must at the same time be admitted that in the majority the superadded scarlatinal attack proves to be very mild.

A noteworthy point is that under these circumstances the local diphtheritic process often again reappears, even though there may have been no membrane seen for two or three weeks. This has a distinct bearing on the prognosis of the case, and lends support to the view promulgated by Roux and Yersin—that the so-called "pseudo-bacillus", which may often be found on the fauces for several weeks after the distinctive signs of diphtheria have passed, is capable of again developing virulent pathogenic properties, and may become all-powerful for harm when the conditions of soil once more become favourable. The inflamed throat in scarlet fever provides it with these very conditions.

The inference that post-scarlatinal diphtheria would be a more serious complication than post-diphtheritic scarlatina is supported by what might be assumed as to the pathology of the two diseases.

In diphtheria the poison is elaborated locally at the seat of the pellicular formation, from whence a supply is continuously given off into the blood and lymph streams, and therefore, when a mucous membrane, previously weakened by an attack of scarlet fever, becomes the point of manufacture of the specific toxine, we should expect that the toxicity of the product would be correspondingly increased. In scarlet fever, on the other hand, although the infection may be first received on the mucous membrane of the fauces, and may even undergo some development there, we have no evidence that the severity of the strictly scarlatinal attack is dependent on the comparative intensity of any local process whatever. This is shown by the fact that the most lethal attacks of scarlet fever are usually characterised by an absence of much faucial affection.

Therefore, beyond the fact that a lowered vitality implies a lessened power of resistance, there would be no reason to expect that the multiplication of the scarlatinal poison would be to any extent influenced by a previous attack of diphtheria.

When scarlet fever is complicated by an attack of measles, the course of the latter disease is modified in my experience in two directions. Firstly, the symptoms of the disease are well marked, but the rash, instead of appearing on the third or fourth day, as is the rule in measles, usually appears at a very much earlier date. Observation on seventy-

eight cases of measles arising in scarlet-fever convalescence during a period of fifteen months in one hospital, showed the rash to be delayed until after the third day in only four instances.

Its most frequent time of appearance was on either the first or second day, and in a large number it was the very first sign of illness.

As these cases all arose in the hospital, in patients whose temperatures were taken daily, we had very good opportunities of observing the exact time at which the first symptoms of measles actually appeared.

Secondly, the disease shows a great tendency to the development of early and serious lung complication, often with an intense rash and persistent after-staining. I always regard with anxiety the occurrence of measles in scarlet-fever convalescence, as the mortality in these cases is considerably higher than it is in the independent disease. The death-rate in this series was 14 per cent., which, curiously, was in exact correspondence with that for the same year in a similar class of cases treated in another hospital. The length of incubation, as I have already mentioned, showed no abnormality, being almost invariably twelve to fifteen days inclusive.

When measles as the primary disease is followed by scarlet fever, the latter disease does not seem to be modified in any particular direction. My own experience of this class of case is comparatively limited, and any literature bearing on the subject is conspicuous by its absence. The gravity of the scarlatinal attack would seem to bear some relation with the severity of the previous attack of measles. Cases in which the two diseases are actually co-incident are not common. Those which I have met with have been almost always very severe, and the symptoms of both are generally well marked and may be usually defined. Care must be taken to separate those cases of scarlet fever in which the rash is of a distinctly measly character, and which in an early stage have some conjunctival injection. Occasionally cases are seen in which it would appear impossible to say with certainty whether the patient is suffering from a somewhat abnormal attack of scarlet fever simply, or whether the two diseases are actually co-incident; but with due care the mistake should not often occur, if one has the opportunity of keeping the case under observation for a day or two.

Children suffering from measles are very prone to the development of diphtheria, and when this complication

does arise, it in the large majority of cases proves fatal. Some time back I had under my care a child who contracted diphtheria in the second week of measles. The disease took an almost malignant form, and the child died in a few hours, but without obvious laryngeal affection. Post mortem, however, the bronchial tubes were found uniformly lined with recently-formed membrane. In most cases the disease takes the laryngeal form, and the question of affording relief by operation becomes a pressing one.

The percentage of recovery in young children after tracheotomy for diphtheria pure and simple is none too hopeful, being rarely as high as 40 per cent., but in this connection the results are very much worse. It is very rarely indeed that either tracheotomy or intubation is successful in saving life in diphtheria when it occurs as a complication of recent measles.

In one of the cases of triple disease to which I have already alluded, in which the distinctive signs of scarlet fever, diphtheria, and measles were all present at the same time, no special modification of either disease was noticeable, but the aggregate severity was too great for the child, aged six, and she died in the early part of the third week of her combined illness.

When either measles is complicated with whooping-cough, or *vice versâ*, the tendency in each case to the development of capillary bronchitis, broncho-pneumonia, and pulmonary collapse, is greatly increased, and the death-rate is correspondingly higher. In these cases the gravity of the case varies inversely with the age of the patient.

Although the course of an attack of whooping-cough, apart from a special liability to pulmonary complications, is practically unaffected by an intercurrent attack of measles, and is certainly not curtailed thereby, yet it is a curious fact that during the febrile stage of the measles the characteristic whoop is often altogether dropped, to reappear when convalescence from measles is established. I have occasionally noticed the same thing to occur during the acute stage of scarlet fever when it has complicated an attack of whooping-cough.

As regards either typhus or enteric fever, owing to the rarity of their observed co-existence with other diseases, I am quite unable to indicate any special peculiarities which may be expected to characterise their behaviour under these conditions. In the foregoing remarks I have contented myself by simply alluding to the association of those

diseases in which, from the number of observed facts, or from their assumed pathology, one might feel warranted in drawing a deduction of more or less validity.

By way of brief recapitulation I would summarise the evidences I have had the honour to bring before you, as follows:—

(*a*) That the presence of one infectious disease in the body, so far from exerting any inhibitory influence in the inception of another, shows a distinct tendency to increase the liability to its occurrence.

(*b*) That this susceptibility bears some relation to the natural severity of the initial affection, and also to the severity of the particular attack.

(*c*) That it is more marked in the case of some diseases than it is in the case of others, so that there exists what may be called a special susceptibility, in some instances corellated between certain members of the group.

As instances of this special susceptibility I would point to the liability of *scarlet-fever* patients to *diphtheria*, and, possibly, to measles and chicken-pox, of *diphtheria* patients to *scarlet fever*, of *measles* patients to *diphtheria* and *whooping-cough*, of *whooping-cough* patients to *measles*. So that there would seem to be a corellated susceptibility between *scarlet fever* and *diphtheria*, and possibly between *measles* and *whooping-cough*.

(*d*) That, in general, the symptoms of one disease, so far from being mitigated by the presence of another, are usually seen in an exaggerated form, whether mingled or in close succession, and their average severity and the consequent mortality are increased in proportion to the propinquity in the incidence of the two disorders.

This malign influence is particularly marked in connection with certain diseases; for example:

Diphtheria is apt to take a very severe form when it follows, or is associated with, *scarlet fever* or *measles*, especially the latter.

Measles is apt to take a severe form when it follows, or is associated with, *scarlet fever* or *whooping-cough;* and *whooping-cough* is apt to be severe when it follows *measles*.

(*e*) Lastly, that in addition to this general modification in the direction of the severity, a particular modification is noticed in respect to the early appearance of the rash in post-scarlatinal measles, the tendency of the disease to assume a laryngeal form when diphtheria occurs as a complication of either scarlet fever or measles, especially the latter, and a temporary dropping of the whoop of whooping-

cough during the febrile stage of an intercurrent attack of measles or scarlet fever.

In writing this paper I have not attempted to quote cases in detail, as to read a number of individual case-notes would have taken up more time than was at my disposal. I have preferred rather to lay before you a digest of my experience in this connection, gathered during the past few years from the study of many thousand cases of infectious disease.

In thus offering you a few of what might be called predigested facts, I may at the same time express the hope that some at any rate may have been presented to you in a form more or less easy of assimilation.

The metaphor is not inappropriate when we remember that the various processes of digestion, of putrefaction, and of fermentation are intimately connected with those zymotic processes which are concerned in the production of infectious disease; and it is to bacteriological research that we must look for gaining a wider knowledge of their underlying phenomena.

ON THE DISTRIBUTION OF THE MORTALITY FROM INFLUENZA IN ENGLAND AND WALES DURING RECENT YEARS.

By H. FRANKLIN PARSONS, M.D.

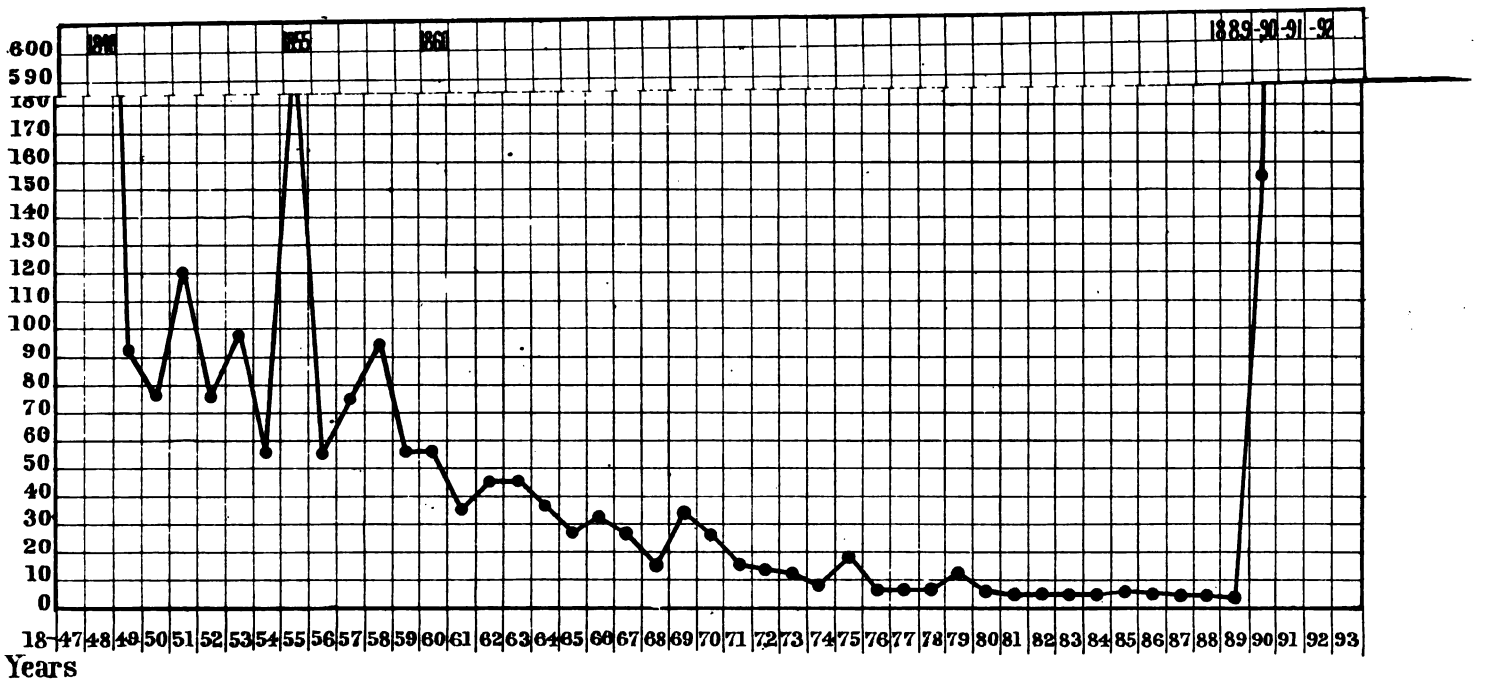
(*Read: May 16th*, 1894.)

THE medical history of the past four or five years has been profoundly modified by the reappearance among mankind, after a lapse of more than forty years, of epidemic influenza; a disease previously known to most of us only through the medical literature and traditions of a by-gone time. The last great epidemic of influenza in this country had been in 1847-8, but for the ten years following this there had still been a considerable number of deaths—over 1,000—year by year, with an increase every third or fourth year. Since 1860, however, the number of deaths in England and Wales ascribed to influenza had steadfastly declined to a vanishing-point, it being doubtful whether the few deaths so certified in ordinary non-epidemic years were properly attributable to the same cause as the epidemic disease. (See Diagram A.)

In the autumn of 1889 the news came that influenza was epidemic in Russia, and later in Germany and other parts of the Continent. The disease reached this country towards the end of 1889, becoming epidemic in London about the new year. From that time to this there have been in this country, and especially in London, no fewer than five epidemics of influenza of greater or less extent and severity, viz.:—1st, in winter of 1889-90; 2nd, in spring and summer of 1891; 3rd, in winter of 1891-2; 4th, in spring of 1893; 5th, in winter of 1893-4.

The history of these several epidemics I propose to study to-night by the aid of information derived from the Registrar-General's reports and other official sources, leaving aside the interesting questions of the origin of the epidemic influenza and its history abroad, and of the etiology, pathology, and clinical features of the disease.

Unfortunately, the Registrar-General's reports do not afford opportunity for studying the distribution in time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and space of the mortality from influenza in the same detail as they do that from other diseases of the zymotic class, since they do not give the number of deaths from influenza in localities less than "Registration Counties", nor, except in the case of London, for periods shorter than one year. There is, further, the doubt how far the deaths registered as from influenza may be taken as an index of the actual fatality from that disease. It is well known that during an epidemic of influenza the deaths from all causes, and especially from diseases of the respiratory organs, show a striking increase, an increase far greater than the number of deaths attributed primarily or secondarily to influenza itself. Again, it is probable that the number of deaths from influenza during the first epidemic of recent years may have been understated, owing to the custom which had previously obtained of applying the term "influenza" to severe cases of ordinary catarrh; so that influenza was regarded as a mild disease, and death, when it occurred, was apt to be ascribed to the pulmonary or other affection by which it was immediately brought about, without mention of the original disease. In later epidemics, on the other hand, influenza had been recognised as a formidable disease from which death might legitimately occur without discredit to the medical attendant; and there may even have been a tendency to attribute to the prevailing epidemic, deaths which at other times would have been ascribed to some other cause.

Another difficulty is that influenza, while it attacks persons of all ages, is especially fatal at the later periods of life. A larger mortality from influenza in one district than in another may mean, therefore, not that the disease was more prevalent, but that a larger proportion of the inhabitants of the former were elderly persons, and a smaller proportion young adults and children.

Admitting, however, these disadvantages, the number of deaths certified as from influenza is, as far as I know, almost the only statistical material available for the study of the distribution of the disease, and I propose to try what lessons can be drawn therefrom.

1. The first epidemic of recent years may be said to have begun in London on January 1st, 1890, though there had been a certain degree of prevalence of the disease in the Metropolis in December, and local epidemics had occurred in several villages in the east of England, even in November. The mortality from this epidemic, however, may be regarded as wholly comprised within the year 1890, the

number of deaths in England and Wales ascribed to influenza in 1889, viz., fifty-five, being less than in any previous year on record. This first epidemic in London was especially notable for its abrupt commencement, rapid culmination, and equally rapid decline. It also probably attacked a larger proportion of the population than later ones; in no subsequent epidemic, so far as my information goes, was there the same rush of patients to the hospitals, nor the same strain on public services, through a large proportion of the staff being disabled at one time. It was not, however, anything like so fatal as the second and third epidemics, or even the fifth.

During the first quarter of 1890 the deaths in London ascribed to influenza numbered 558, of which 304 occurred in the four weeks ending January 25th. During those four weeks the deaths in London exceeded the average of corresponding weeks in the previous ten years by 1,958, to which death-roll an excess of deaths from diseases of the respiratory organs other than phthisis contributed 1,434, so that these, with the 304 deaths from influenza, account for all but 200 of the total excess. It must be remembered, however, that January 1890 was, after the first week, a remarkably mild and genial month, with plenty of sun and breeze; a month, therefore, in which the death-rate might have been expected to have fallen below the average instead of exceeding it, so that the total mortality due to the first epidemic of influenza in London may have been really greater than appears from the above figures.

The epidemic which had begun in some places in the south-east of England in the end of December, was general in the southern, midland, and eastern counties by the end of the first two weeks of January. In the western counties of England it occurred later in January, reaching the Scilly Isles about the middle of February. Many districts in the north and north-west counties of England also were not invaded by the epidemic till the middle of February, and there were a few remote places in hilly districts in the north and west which were only reached by it at the beginning of March. By the end of April it had everywhere subsided, though it is open to doubt whether the disease may not have been still present in a latent or sporadic form. In London there were only three weeks in 1890 in which no deaths were registered from influenza.

2. The second epidemic began about the middle of the first quarter of 1891, the disease seeming to revive independently in several different parts of the country, viz., in

Yorkshire, in the counties on the Welsh border, and in some rural districts in the south of England, in Wiltshire, Hampshire, and neighbouring counties. Of the large towns, the first to suffer was Hull, where the epidemic began about the middle of March. Sheffield was attacked about three weeks later, and the other large Yorkshire towns towards the end of April. It had also by the end of April reached Manchester, Birmingham, and London, and by the middle of May almost the whole country was affected. This second epidemic was very severe in many of the Yorkshire, Lancashire, and Midland towns, especially Sheffield, Oldham, and Huddersfield, and in Lincolnshire and North Wales; and indeed it was severe generally all over England, except in the south-west counties, where it appears to have been mild.

In London the total mortality reached a high figure during this epidemic, and continued above the average for a period of ten weeks, ending June 27th. During this period the deaths ascribed primarily to influenza amounted to 1,941, besides 373 in which it was registered as a secondary cause. During the same period the total deaths were in excess above the average of the corresponding weeks in the ten preceding years by 4,815, the excess above the average of deaths from diseases of the respiratory organs amounting to 2,269. Thus the excess in deaths from diseases of the respiratory organs with those ascribed primarily or secondarily to influenza make up 4,583 out of the total excess of 4,815 deaths, leaving 232 only as due to other causes. This great mortality was due, as also in the succeeding epidemic, to the frequency with which the influenza was complicated with a peculiar and fatal form of pneumonia.

This second epidemic seems to have subsided about the end of June or beginning of July, but the interval between it and the third was bridged over, according to the testimony of observers in several districts, by a succession of sporadic cases, and in London there was only one week, viz., that ending October 24th, 1891, in which no death from influenza was registered in London.

3. The third epidemic, which began in October 1891, seems, like the second, to have revived independently in several different quarters of Great Britain. One of these was in Scotland and the northern counties of England, another in South Wales, Cornwall, and other counties bordering on the Bristol Channel, and another again in Kent. It was epidemic in Plymouth, Bristol, and Newcastle-on-Tyne in November,

where it occasioned a high rate of general mortality in November and December 1891. In London, however, and in other large towns of the south of England, the epidemic did not begin until the last few days of December or the beginning of January, (about the same time, in fact, as the first epidemic two years before), and in some other towns —*e.g.*, Nottingham—not until later still, towards the end of January. The mortality from this epidemic, therefore, is chiefly comprised within the year 1892.

In London the period covered by the epidemic may be taken as the six weeks ending February 13th, 1892. During this period the deaths attributed primarily to influenza numbered 1,805, besides 315 of which it was given as a secondary cause. The highest number of deaths registered from influenza in any one week was 506, in the week ending January 23rd, 1892, a number higher than in any other week on record since the establishment of civil registration. The highest weekly number in any previous epidemic had been 319 in the week ending May 23rd, 1891. The great fatality of this epidemic, like that of 1891, was owing to the prevalence of fatal pulmonary complication, especially pneumonia: it was probably also due partly to the severe cold weather at the time. During the six weeks of the epidemic the total deaths in London exceeded the average of corresponding weeks in the previous ten years by no fewer than 5,921, of which 2,892 were the excess from diseases of the respiratory organs; these, with the deaths ascribed primarily or secondarily to influenza, account for 5,012 out of the total excess, leaving 909 to other causes.

It may here be mentioned as probably indicating a greater readiness on the part of medical men to recognise influenza as the cause of death, that whereas in the first epidemic the deaths attributed to influenza bore to the excess of deaths from diseases of the respiratory organs a ratio of only 1 to 4.75; in the second and third epidemics the corresponding ratios were 1 to 2.1 and 1 to 2.8.

The third epidemic was especially fatal in the south-western, southern, and eastern counties of England; the large Midland, Yorkshire, and Lancashire towns which had suffered so severely in the second epidemic having been as a rule only lightly affected, while in several of them influenza is said not to have been epidemic at all at this time.

In most districts the epidemic prevailed during the first quarter of 1892, chiefly in January and February, and it seems to have been generally over by the end of the quarter,

though occasional deaths ascribed to influenza often occurred on into the summer, and indeed many places are stated never to have been since entirely free from sporadic cases. In London, it will be observed that no week since the end of 1891 has passed without two or more deaths having been registered from influenza.

4. The fourth epidemic of influenza, if such it can be called, differed markedly from those already described in having a far less abrupt commencement, culmination, and decline. Its course was protracted and irregular, being evidenced in London only by a small increase in the weekly number of deaths from influenza from about the second week in January 1893 to the second week in June, the largest number of deaths in any one week being 49 in the week ending April 8th. In fact, its course resembled rather the seasonal increase of an endemic disease than the abrupt invasion characteristic of epidemic influenza. The course, however, of the first epidemic in 1890 was somewhat similar in certain towns; *e.g.*, Manchester and Sheffield, in which it was mild, protracted, and irregular, whereas the second epidemic in the same towns was sudden and severe. Although in the first half-year of 1893 the number of deaths from influenza in any one week was not high compared with other epidemics, yet the disease continued prevalent so long that the total number of deaths from this cause was considerable, being 710 in the half-year against 605 in the first half-year of 1890. There was, however, no accompanying increase, as in other epidemics, in the total deaths, or in those from diseases of the respiratory organs, these remaining below the average almost throughout the half-year, with the exception only of the first two weeks in January, which corresponded to a period of severe frost and fog. The prevalence of influenza in the early months of 1893 has been noticed in many parts of the country, but the cases appear to have been, as a rule, mild and not very numerous. I have not been able to make out any definite sequence of attack in different parts of the country, except that it seems to have been first prevalent in Kent and Yorkshire. The interval between the fourth and fifth epidemics was bridged over by a chain of sporadic cases in many districts, and in London the weekly number of deaths registered from influenza during the summer and autumn of 1893 never fell below three.

5. The fifth epidemic commenced in London in the early part of November 1893, but in several districts in the Midlands, west and north, it was noticed about the middle of

October, and in one village in Lincolnshire in September. In most districts its incidence was in November and December 1893, running on in some into January 1894.

Though somewhat more prolonged, the course of this epidemic in London resembled that of the earlier ones in its abrupt ascent, its distinct culmination, and its decline, rapid at first and afterwards more gradual. Like them, also, it was accompanied by an increased mortality from all causes, and especially from diseases of the respiratory organs. During the seven weeks ending December 23rd, 1893, the deaths from all causes registered in London exceeded the average by 3,557, while those from diseases of the respiratory organs did so by 1,560. There were during the same period 590 deaths from influenza, which, with the excess of deaths from diseases of the respiratory organs, make up together 2,150 out of the total excess of deaths, leaving 1,407 to be accounted for by other causes. Scarlet fever, diphtheria, and whooping-cough caused a mortality in London above the average during this period. The proportion of the deaths registered as from influenza to the excess of deaths from diseases of the respiratory system was 1 to 2.6.

This epidemic is, however, generally stated to have been of milder character than the second and third epidemics, without the same tendency to pulmonary complications. On the other hand, throat symptoms seem to have been a more frequent feature than in previous epidemics.

The course of influenza in London, so far as indicated by the registered deaths therefrom, week by week, between December 1889 and the present time, is shown in the accompanying diagram B by a broken line. A continuous line indicates, on a scale of two-fifths that of influenza, the total deaths from diseases of the respiratory organs. It will be seen how markedly the number of the latter is increased during an epidemic of influenza, though it is also increased during periods of frost and fog when influenza is not epidemic. The number of deaths from diseases of the respiratory organs attains its maximum before the culmination of the influenza epidemic, and afterwards falls to the average while a considerable number of deaths from influenza are still occurring; the explanation of this is probably that many of the deaths ascribed to influenza occur from sequelæ at a somewhat late stage. It will be observed, too, that the weekly number of deaths ascribed to influenza during the intervals between the later epidemics has been larger than between the earlier ones, and

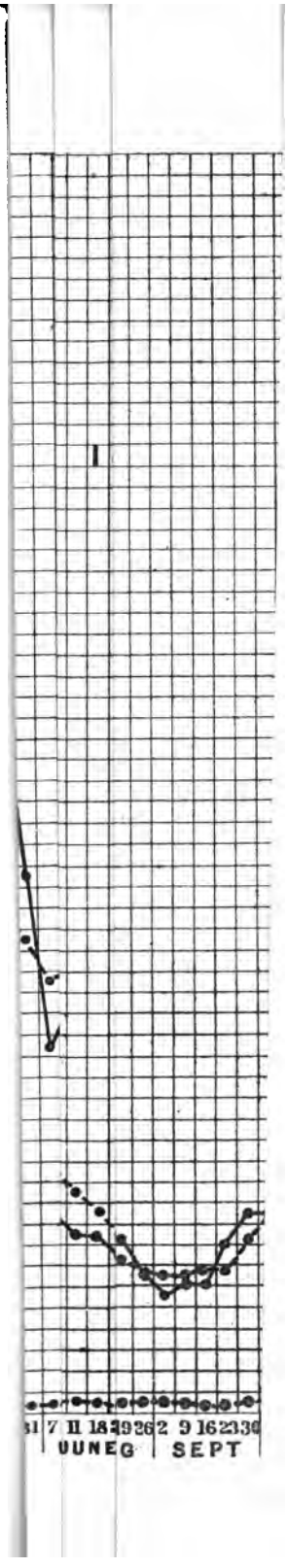
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TABLE C.

Comparison of Mortality in London during the several Recent Epidemics of Influenza.

Epidemic.	Duration.	Mean Daily Temperature. Departure from Average of 10 years.	Deaths from Influenza.		Excess of Deaths above Average of 10 years.			Ratio of Deaths from Influenza to Excess from Respiratory Diseases.
			Primary.	Secondary.	All Causes.	Diseases of Respiratory Organs.	Other Causes than Influenza and Respiratory Diseases.	
I.	4 weeks ending Jan. 4th to 25th, 1890.	+ 3.7° F.	304	...	1958	1454	200	1 4.75
II.	10 weeks ending April 25th to June 27th, 1891.	− 1.5° „	1941	378	4815	2269	232	1 2.1
III.	6 weeks ending Jan. 9th to Feb. 13th, 1892.	− 1.0° „	1805	315	5921	2892	909	1 2.8
IV.	14 weeks ending Feb. 18th to June 10th, 1893.	+ 3.5° „	595	..	Nil.	Nil.	Nil.	—
V.	7 weeks ending Nov. 11th to Dec. 23rd, 1893.	− 0.8° „	590	...	3557	1560	1407	1 2.6

without breaks in the succession; indicating that the disease has become domiciled among us, in nomenclature at least.

The comparative figures of the mortality in London occasioned by the several epidemics are also given side by side in a table C. It will be seen that the first epidemic in 1889-90, which attracted so much attention at the time, occasioned a mortality small in comparison with the second and third epidemics, and less even than the fifth, which has recently passed over us with but little notice.

The recent epidemics have all occurred in either the first, second, or fourth quarters of the year, the third quarter or later summer months being almost free.

The death-rates in London from influenza, as given in the Registrar-General's weekly returns for the past four years, have been as follows:—

1890	152	per million inhabitants.
1891	554	„
1892	532	„
1893	347	„

Having thus traced the time distribution of the influenza mortality of recent years by the aid of the Registrar-General's weekly figures for London (where the course of the disease has corresponded, I believe, pretty closely with its general course in the country), we will now turn to consider the local distribution of the recent influenza mortality in England and Wales.

Except so far as the deaths from influenza in particular sanitary districts are recorded in the reports of medical officers of health, the smallest areas for which their numbers can be given are "Registration Counties", and the figures can only be given up to 1892. The number and proportion to population of deaths from influenza in the several registration counties in 1890-91-92 (of which the middle year, 1891, happens conveniently for our present purpose to be the census year) are given in the accompanying table D and in diagram E, from which the following conclusions may be drawn.

1. The death-rate from influenza in England and Wales per million inhabitants was 157 in 1890, 572 in 1891, and 540 in 1892; the average annual rate for the three years being 423.

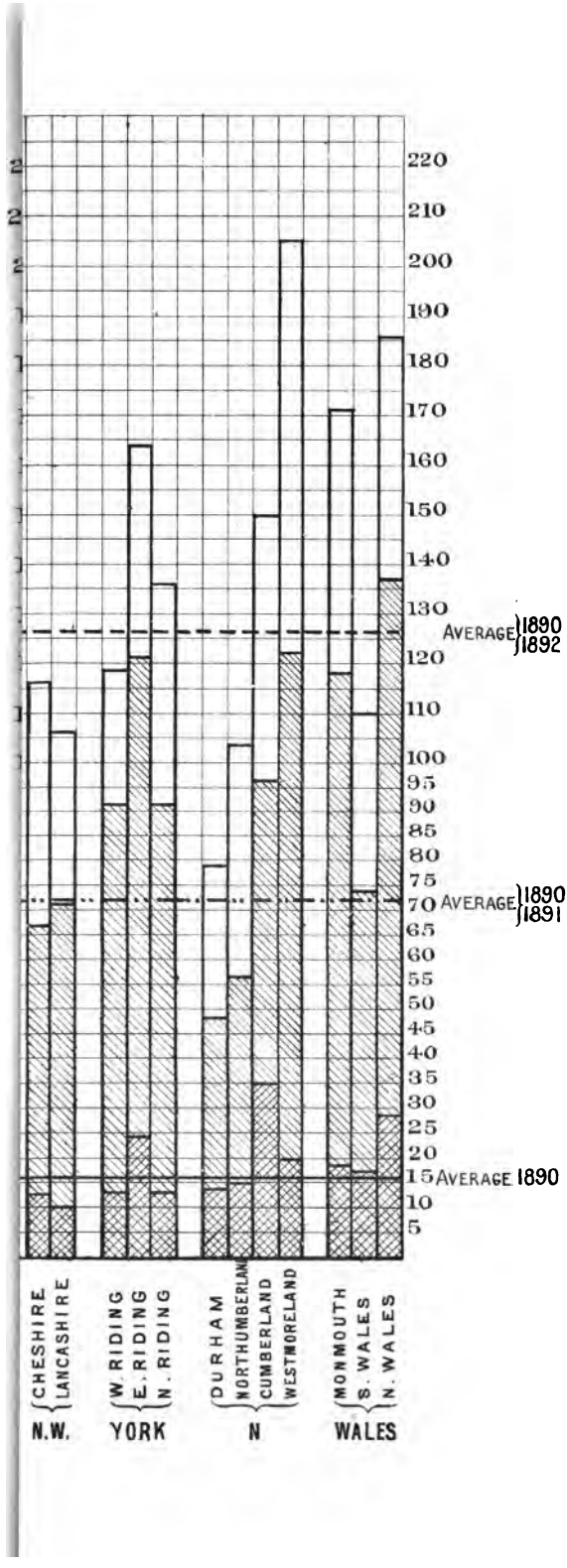
2. In each year the influenza death-rate in London approximated very closely to that for the whole kingdom; but elsewhere considerable differences are found between the death-rates in different counties in the same year, and also between the relative positions of the same county in different years.

TABLE D.

Deaths from Influenza in England and Wales in 1890, 1891, 1892, *arranged according to Registration Divisions and Counties.*

Registration County.		Population. 1891.	Deaths from Influenza.				Rate per 1000 Inhabitants.			
			1890.	1891.	1892.	Total in 3 Years.	1890.	1891.	1892.	Average.
	London	4,211,743	624	2,302	2,230	5,156	.15	.55	.53	.41
South Eastern	Surrey { extra } ...	572,092	91	300	501	892	.16	.52	.87	.54
	Kent { metrop } ...	806,297	151	261	594	1,006	.19	.32	.74	.41
	Sussex	554,542	94	214	579	887	.17	.39	1.04	.53
	Hampshire	666,250	94	183	717	994	.14	.27	1.07	.50
	Berkshire	268,357	65	114	266	445	.24	.41	.99	.55
South Midland	Middlesex { extra }	574,999	91	250	418	759	.16	.43	.72	.44
	Herts { metrop. }	215,179	43	89	228	360	.20	.41	1.06	.56
	Bucks	164,442	41	103	158	302	.25	.63	.97	.62
	Oxford	188,220	40	79	215	334	.21	.42	1.14	.59
	Northampton ...	308,072	66	291	210	567	.21	.95	.68	.61
	Huntingdon ...	50,289	3	34	35	72	.06	.68	.69	.48
	Bedford	165,999	27	97	143	267	.16	.58	.86	.54
	Cambridge	196,269	40	91	160	291	.20	.46	.81	.49
Eastern	Essex	761,191	108	319	621	1,048	.14	.42	.82	.46
	Suffolk	353,758	49	100	388	537	.14	.28	1.10	.51
	Norfolk	460,362	69	254	436	759	.15	.55	.95	.55
South Western	Wilts	255,119	72	132	241	445	.28	.52	.94	.58
	Dorset	188,995	48	31	251	330	.25	.16	1.33	.58
	Devon	636,225	118	208	457	783	.19	.33	.72	.41
	..	318,583	47	181	121	349	.15	.57	.38	.36

	Somerset	510,076	131	215	335	681	.26	.42	.66	.45
West Midland	Gloucester	548,886	114	235	283	632	.21	.43	.52	.39
	Hereford	113,346	32	111	114	257	.28	.98	1.01	.76
	Salop	254,765	72	238	250	560	.28	.94	.98	.73
	Stafford	1,103,452	164	472	461	1,097	.15	.43	.42	.33
	Worcester	422,530	74	182	302	558	.18	.43	.72	.44
	Warwick	801,738	72	520	243	835	.09	.65	.30	.35
North Midland	Leicester	379,286	44	199	108	351	.12	.53	.28	.31
	Rutland	22,123	3	30	12	45	.13	1.36	.55	.68
	Lincoln	467,281	78	555	163	796	.17	1.19	.35	.57
	Nottingham	505,311	82	315	186	583	.16	.62	.37	.38
	Derby	432,414	52	389	156	597	.12	.90	.36	.46
North Western	Cheshire	707,978	93	383	349	825	.13	.54	.49	.39
	Lancashire	3,957,906	401	2,394	1,416	4,211	.10	.61	.36	.32
Yorkshire	West Riding ...	2,464,415	326	1,930	640	2,896	.13	.79	.26	.39
	East Riding ...	400,085	96	393	148	637	.24	.98	.37	.53
	North Riding ...	354,382	45	277	158	480	.13	.78	.45	.45
Northern	Durham	1,024,369	140	411	253	804	.14	.40	.25	.26
	Northumberland ...	506,030	76	214	237	527	.15	.42	.47	.35
	Cumberland	266,549	93	151	156	400	.35	.56	.59	.50
	Westmoreland ...	66,215	13	67	55	135	.20	1.02	.83	.68
Welsh	Monmouthshire ...	275,242	49	274	147	470	.18	1.00	.53	.57
	South Wales ...	1,050,073	163	614	377	1,154	.15	.59	.36	.37
	North Wales ...	451,090	129	489	223	841	.28	1.09	.49	.62
	Total ...	29,002,525	4,523	16,686	15,737	36,946	.157	.572	.540	.422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3. In 1890 the death-rate from influenza per 100,000 inhabitants ranged from 6 in Huntingdonshire and 9 in Warwickshire to 35 in Cumberland; it was generally low in the manufacturing and mining counties of the north, but high in the hilly counties of the west, and in some of the South Midland counties.

4. In 1891 the death-rate from influenza exceeded that for 1890 in every county with the exception only of Dorsetshire, and ranged from 16 per 100,000 in Dorset to 136 in Rutlandshire. It exceeded 1 per 1,000 in Rutland, Lincolnshire, North Wales, Westmoreland, and Monmouthshire, and was high also in Yorkshire, Derbyshire, Herefordshire, Shropshire, and Northamptonshire.

5. In 1892 the death-rate from influenza per 100,000 inhabitants ranged from 25 in Durham to 133 in Dorsetshire, and exceeded 1 per 1,000 also in Oxfordshire, Suffolk, Hampshire, Herts, Sussex, and Herefordshire. Generally speaking, it was high in the southern counties, and low in the manufacturing and mining ones of the Midlands and North.

6. In many counties an inverse proportion is perceptible between the death-rates from influenza in 1891 and in 1892; those counties which suffered severely in the former year having escaped lightly in the latter year, and *vice versâ*. Thus Dorset, which was lowest in 1891, was highest in 1892; and in all the south-eastern and eastern counties, and most of the south midland ones, as well as in Wilts, Devon, and Worcestershire, the death-rate from influenza was considerably below the average in 1891 and above it in 1892. The same would probably have been the case in other counties which suffered severely during the third epidemic, *e.g.*, Cornwall, Somerset, Gloucester, and Northumberland, but for the circumstance that in these counties the epidemic was established comparatively early in the autumn of 1891, so that the mortality from it came partly into that year. On the other hand, Rutlandshire, Lincolnshire, Derbyshire, Warwickshire, and Yorkshire, which had a high death-rate in 1891, had a low one in 1892.

7. Certain counties, however, as Buckinghamshire and Northamptonshire, Herefordshire and Shropshire, Rutlandshire, Westmorland, and North Wales, seem prone to a higher death-rate than their neighbours in each year.

8. Taking the average annual death-rate from influenza for three years, we find that the twelve counties in which it has been lowest are in order as follows:—

Durham	26	Cornwall	36
Leicester	31	South Wales	37
Lancashire	32	Nottingham	38
Stafford	33	West Riding	39
Northumberland	35	Cheshire	39
Warwick	35	Gloucester	39

in all of which the death-rate from influenza was under 40 per 100,000.

The twelve highest were in order:—

Hereford	76	Northampton	61
Salop	73	Oxford	59
Rutland	68	Wilts	58
Westmoreland	68	Dorset	58
Buckingham	62	Monmouth	57
North Wales	62	Lincoln	57

per 100,000 population.

Speaking generally, we may say that the mortality from influenza was below the average in the mining and manufacturing counties in the North and Midlands, and above the average in the southern and Midland agricultural counties, and in the hilly counties towards the west coast.

The age distribution of the mortality from influenza is illustrated by diagram F, in which is shown the number of deaths from influenza in the three years 1890-92 per 1,000 persons living at each age or group of ages, and of each sex. It will be seen that the mortality from influenza is somewhat high in the first year of life, but declines, rapidly at first and then more slowly, to a minimum between the ages of ten and fifteen. After this period of life it increases, at first gradually until middle life is reached, and then nearly doubling itself in each successive decade up to extreme old age.

The death-rate from influenza in females is lower than that in males at every age, except between two and three and between five and ten, at which ages the deaths of females have slightly exceeded those of males.

The greater fatality of influenza at the later periods of life to some extent explains the excess of mortality from the disease in the agricultural counties as compared with the manufacturing and mining ones; the former containing a larger proportion of elderly people, who remain behind, while the young adults migrate to the towns and coal-fields, there also producing a large number of children. Thus the latter counties contain a larger proportion of inhabitants at the ages at which the fatality of influenza is lowest, viz., children and young adults, while fewer of their inhabitants live to old age.

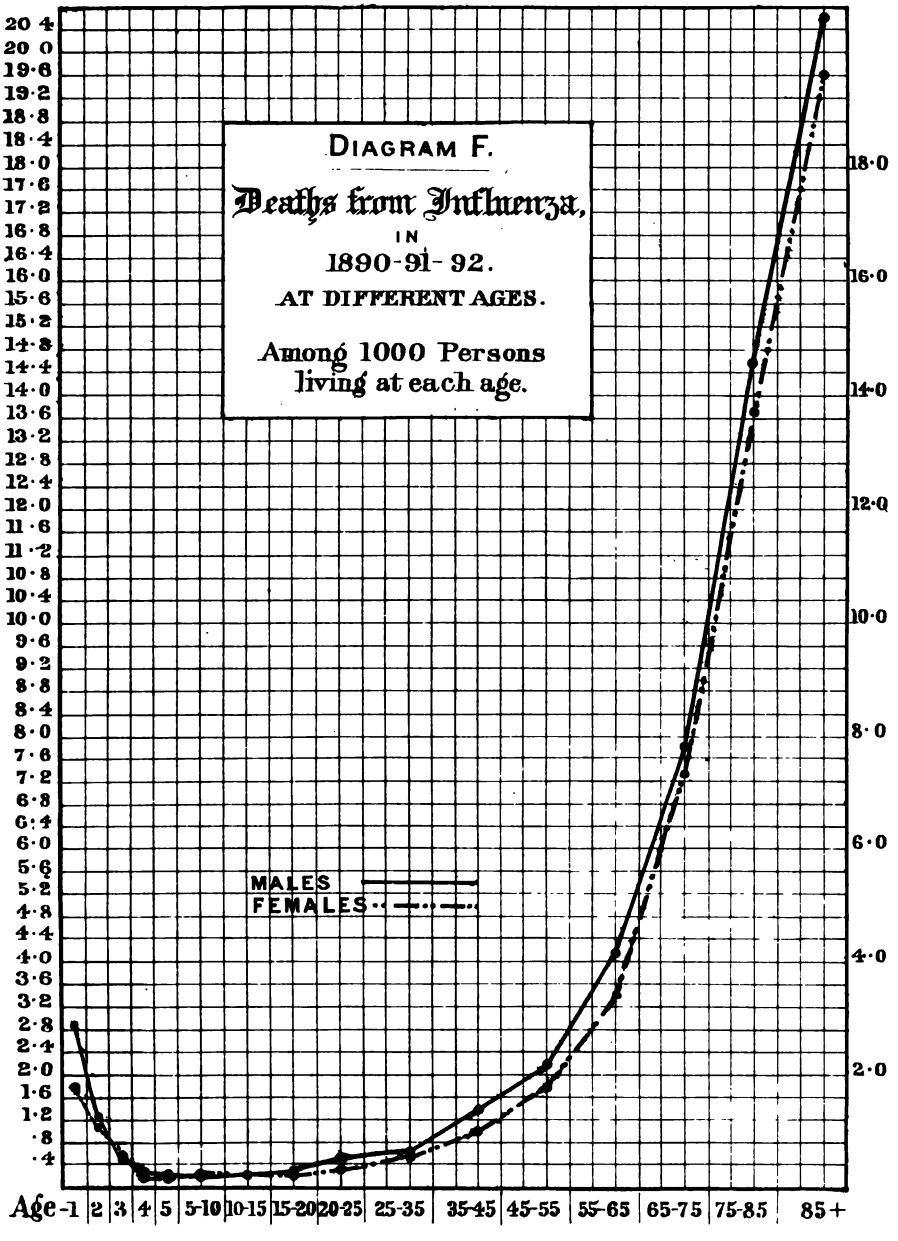
DIAGRAM F.
Deaths from Influenza,
IN
1890-91-92.
AT DIFFERENT AGES.
Among 1000 Persons
living at each age.
MALES
FEMALES
20·4
20·0
19·6
19·2
18·8
18·4
18·0
17·6
17·2
16·8
16·4
16·0
15·6
15·2
14·8
14·4
14·0
13·6
13·2
12·8
12·4
12·0
11·6
11·2
10·8
10·4
10·0
9·6
9·2
8·8
8·4
8·0
7·6
7·2
6·8
6·4
6·0
5·6
5·2
4·8
4·4
4·0
3·6
3·2
2·8
2·4
2·0
1·6
1·2
·8
·4
18·0
16·0
14·0
12·0
10·0
8·0
6·0
4·0
2·0
Age -1 2 3 4 5 5-10 10-15 15-20 20-25 25-35 35-45 45-55 55-65 65-75 75-85 85+

The difference, however, does not appear to be wholly thus explicable. Thus, taking on the one hand the county of Durham, which had during the three years 1890, 1891, and 1892 the lowest proportional mortality from influenza, and on the other hand the two counties which had the highest mortality, viz., the adjoining and similar counties of Hereford and Salop, and assuming that the distribution of influenza was uniform throughout the kingdom, and that the local differences in the mortality therefrom were due solely to differences in the age-constitution of the population, I find that the number of deaths from influenza during the three years per 100,000 inhabitants would be: in Durham 37, in Hereford and Salop 52. As a matter of fact, however, it was in Durham 26, and in Hereford and Salop 74, so that the difference in the age-constitution of the population alone barely accounts for one-third of the difference in the rates of their mortality from influenza. Certain counties, also, in which the influenza death-rate, calculated on an age basis, comes out equal or nearly so, have in fact had rates widely different, *e.g.*, South Wales and Monmouth, Cornwall and Dorset, Kent and Northampton.

The following are the rates of influenza mortality in certain typical counties, as calculated on the above basis, and as they actually were, on the figures recorded by the Registrar-General.

County.	Deaths from Influenza per 100,000 Inhabitants. Average of 1890-92.	
	Calculated.	Actual.
Durham	37	26
Lancashire	37	32
Staffordshire	39	33
Northumberland	40	35
London	40	41
Leicestershire	41	31
Warwick	41	35
South Wales	41	37
Monmouth	41	57
Kent	46	41
Northampton	46	51
Westmoreland	46	68
Buckingham	48	62
Lincoln and Rutland	49	57
North Wales	51	62
Dorset	51	58
Cornwall	52	36
Hereford and Salop	52	74

Certain differences between the proportionate mortality at different ages and in the two sexes, in the three years of the series 1890, 1891, and 1892 may here be noticed.

During the three successive years the incidence of the

mortality has fallen increasingly upon persons advanced in life. This is shown by diagram G, in which the percentage contributed by persons of different ages to the total mortality from influenza in the respective years is compared.

The years 1890 and 1891 differed from nearly all previous years, epidemic and non-epidemic, in that the number of deaths of males ascribed to influenza exceeded that of females. In 1892, however, the usual proportion was reverted to, the deaths of females from influenza exceeding those of males. This is probably connected with the greater incidence of influenza mortality in the latter years upon old persons, the number of females living at the later periods of life considerably exceeding that of males.

The following conclusions may, I think, be drawn from the facts I have recorded:—

1. The behaviour of influenza on its introduction to this country in 1889-90, its rapid spread, culmination, and speedy decline to almost complete disappearance, are in contrast with its behaviour in more recent years, in which the epidemics have been more protracted and the disappearance of the disease between them less complete. The former behaviour may be regarded as that of a disease newly introduced into virgin soil, while the latter resembles rather the seasonal increase of an endemic disease.

2. Influenza may assume an epidemic form at almost any time of the year, but generally during late autumn, winter, or spring, the third quarter of the year having been free in recent years (the epidemic of 1831 occurred in London in June and July and that of 1788 in September). Its epidemic prevalence does not depend on any particular kind of weather, but its fatality is increased by cold weather. Of the recent epidemics, those which coincided with a daily mean temperature below the average have been very fatal, while those during which the daily mean temperature has been above the average have been comparatively mild.

3. The fatality of influenza in different localities is largely influenced by the age-constitution of the population; it causing most deaths in those containing the largest proportion of elderly inhabitants. The whole of the difference between different counties as regards influenza mortality cannot, however, be thus explained.

4. A severe epidemic of influenza appears to confer upon a locality a certain degree of protection against another.

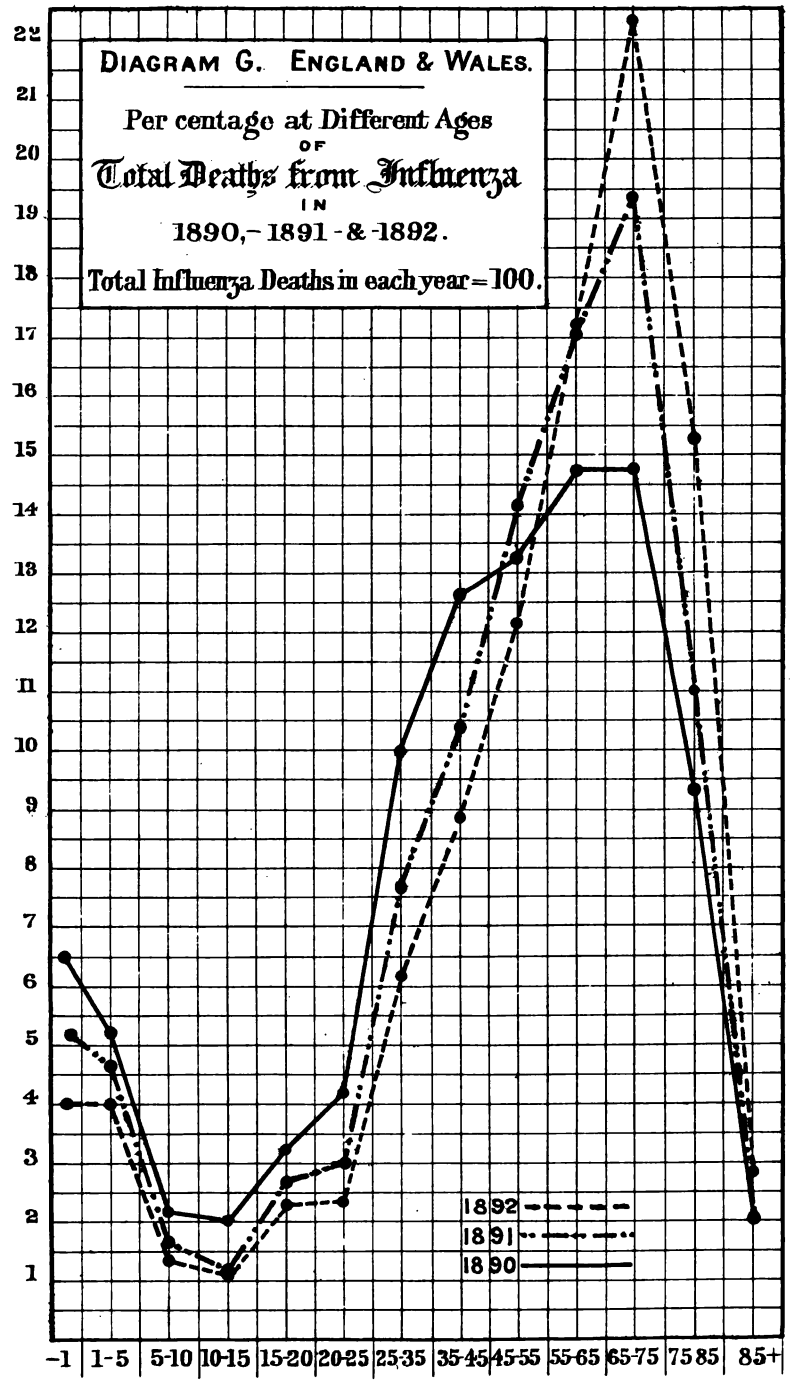
DIAGRAM G. ENGLAND & WALES.
Per centage at Different Ages
OF
Total Deaths from Influenza
IN
1890,-1891-&-1892.
Total Influenza Deaths in each year=100.
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
1892
1891
1890
-1
1-5
5-10
10-15
15-20
20-25
25-35
35-45
45-55
55-65
65-75
75-85
85+

THE OUTBREAK OF CHOLERA IN MESOPOTAMIA AND SYRIA IN 1889, 1890, AND 1891.

By E. D. DICKSON, M.D.,
Physician to the British Embassy at Constantinople.

THE sudden manifestation of cholera in Mesopotamia, at a time when no vestige of the disease was known to exist in any part of the Ottoman or Persian dominions, took everybody by surprise, and few would believe at first that the outbreak was really one of the dreaded Asiatic scourge.

The rise of the Euphrates and Tigris in 1889 was insignificant. Navigation in the great canal of Shat-el-Haï, which connects the Tigris with the Euphrates, ceased in May, and the extensive marsh lying between Shatra and Nasriyeh soon became quite dry.

A severe form of typhoid prevailed in April amongst the Arabs of the tribe of Bu-Musafir, in the district of Hawas, near Hilla. In June malaria fevers were very fatal at Tahmasia, a village near Hilla, and lying between the Euphrates and the canal of Hindiyeh; and on the 9th of July the military doctor stationed at Nasriyeh announced to the authorities of Bagdad the existence at Nasriyeh of a very fatal form of *pernicious fever*. On the 21st of July Dr. Lubicz, the sanitary inspector of Bagdad, informed the Constantinople Board of Health that malaria fever, of a pernicious type, had been very prevalent since April throughout Mesopotamia, and had caused many sudden deaths in the district of Muntefik. The heat, moreover, had been very oppressive, the daily temperature in the shade at Bagdad ranging between 44° and 46° C., and had risen to 48° on the 16th of July.

The territory of Muntefik, adds Lubicz, comprises the southern portion of *Irak-arebi* (lower Mesopotamia), and extends from the Euphrates to the Howizeh marshes on the Persian frontier. The land is swampy, intersected with numerous canals, and subject to frequent inundations. The temperature is very high in summer, the Centigrade thermometer rising in July and August to 68°. In winter, however, the climate is mild, but damp. The *sam* (simoon),

or west wind, prevails in June and July. When the wind blows from the south the air becomes very oppressive, but a dead calm drives everyone out of his wits. Malaria fevers are common, and usually of a mild type. From April to the end of November the air fills in the evening with swarms of insects that come from the marshes, and compel every Arab to protect himself by means of a mosquito-net. The natives are a well-built, hardy race, who live in *serifehs* (huts made of reeds and matting), and these contain no other furniture than a rotten mat and a mosquito-net. Their food is rice and fish, and their drink the water taken from the marshes. A *famine* in Mesopotamia, observes Lubicz, would be an event almost unknown, because the crops are not dependent on the amount of rain that might fall there. *Suk-esh-Shiuh* was formerly the capital of the Muntefik district, but is now an almost deserted place, and in ruins. It would be abandoned altogether were it not for the traffic carried on there in a small fish caught in the marshes of that neighbourhood, and which are salted and dried in the sun, and are not only reckoned a dainty article of food, but are also considered a sovereign remedy for every evil.

The Muntefik Arabs, since their unsuccessful attempt made in 1880 to throw off the Turkish yoke, have fallen into poverty and a wretched condition. They cultivate, however, rice, barley, and Indian corn, and rear numerous herds of buffaloes. One source of wealth is still left to them, viz., the crop of dates afforded by the immense forests of palm-trees that cover the land on both sides of the Shat-el-Arab. The export of these dates from Bassora amounted in 1872 to eight tons; in 1874 to twenty-five tons; and in 1888 to sixty thousand tons. A number of horses, varying from 1,500 to 5,000, are, moreover, annually exported from the Muntefik to British India. They are sent there towards the end of October, after the monsoon season is over, and the Arab grooms who take them to India return to their country in the spring.

On the first of August 1889 the Mutessarif (governor) of Nasriyeh telegraphed to the Vali (governor-general) of Bagdad that a fatal outbreak had manifested itself in the district of Muntefik, and requested that Dr. Gazala might be sent there to ascertain its nature. A subsequent telegram, however, dated on the 2nd, stated that *cholera* had broken out at *Shatra*, on the Shat-el-Haï canal.

Dr. Lubicz, on receiving this news from the Vali, ordered Dr. Gazala to proceed at once to Shatra, and Gazala quitted

Bagdad on the same day, and arrived at Nasriyeh on the 7th. Dr. Lubicz followed him on the 6th of August, arriving at Shatra on the 12th, and at Nasriyeh on the 13th.

Shatra is a small town situated in a swamp, and close to a branch of the great canal connecting the Tigris with the Euphrates, called Shat-el-Haï. Shatra had, before the outbreak, a population of five thousand persons, living mostly in Serifehs. On Lubicz's arrival there he found the town deserted, and its inhabitants scattered all over the land extending between Bassora and Bagdad. The governor's residence at Shatra (a mere hut) was occupied by two zaptiehs (policemen) in a convalescent state from a recent attack of the malady. The governor had died of it, and his successor, who had just arrived there a day or two before Lubicz, had left the place after losing three of his attendants. He had gone to Begha, a place not far from Shatra. Lubicz found eleven patients in the military hospital; three of them were convalescents from an attack of the malady, and the others were still suffering more or less from it. One of them, who had been attacked during the night, was in a state of collapse.

Dr. Lubicz is led to believe, from the information he obtained at Shatra, that the outbreak could not have declared itself there before the 18th of July, because it was on the 19th of that month that the attention of the military doctor was, for the first time, drawn to a *suspicious* case. It was that of a boy, ten years old, son of the butcher who supplied meat to the troops. The boy had been suffering for eight days from a severe attack of fever, when suddenly he was seized, on the 19th July, with vomiting and purging, and died within five hours from the commencement of the attack.

The Binbashi (major), the army surgeon, and the other military officers stationed at Shatra, told Lubicz that, for several days previous to this event, they had noticed that the site on the embankment of the canal resorted to by the inhabitants of Shatra as a public latrine was covered with liquid alvine discharges.

After the attack of the butcher's boy on the 19th other similar cases manifested themselves. On the 25th sudden deaths became frequent, and a soldier died of an attack that had lasted only eight hours. The number of deaths in town doubled on the 26th July, and it was then deemed advisable to inform the authorities that pernicious fever of a *choleraic* type prevailed there. The number of deaths

continued to increase very considerably, and on the 27th the Caïmakam (lieutenant-governor) of Shatra was attacked, and died after a few hours' illness. The Binbashi's wife and his two children also died after twenty-four hours' suffering. The military doctor also was attacked with the malady, and a general panic set in, and the inhabitants fled away from the place in every direction. On the 28th the deaths in Shatra had risen to 133, the highest number attained in a day during the whole period of the duration of the outbreak. The Binbashi and several soldiers were attacked on the 29th, and notwithstanding that Shatra was then almost entirely deserted by its inhabitants, 52 deaths occurred in it on that day. After the 29th the deaths began to diminish up to the 15th of August, when they ceased altogether. From the 28th of July to the 15th of August 494 deaths were registered in Shatra, but the total number, from the beginning to the end of the outbreak, is believed to have been 700.

Cholera in the meanwhile had broken out at Bassora. I shall give an account of this outbreak when I have done with that of the Muntefik district.

When Gazala arrived at Shatra he recognised at once that the outbreak was one of *Asiatic cholera*. The malady, he observes, showed itself in every instance and in every locality with similar features. He classifies the cases that came under his notice into three types: the rapidly fatal (*forme foudroyante*); the severe; and the mild form of the malady. The rapidly fatal form presented no marked premonitory symptoms. The patient was seized suddenly with intense pain in the epigastric region, with nausea, vomiting of blood, and one or two discharges from the bowels, followed by death. The characteristic features of this form of cholera, according to Gazala, were the cramps, the internal burning heat, the nervous agitation, and the short duration of the malady, an attack never lasting more than three hours. Gazala saw only three cases of this rapidly fatal type: one of them occurred at Nasriyeh, and had had no vomiting nor purging at all (*cholera sicca*), and the two other cases presented the following symptoms. The patients could not speak distinctly, but replied in monosyllables to his questions; the pulse was small, nervous, and irregular, the respiration accelerated, the tongue furred, the eye fixed, the pupil sensitive and slightly dilated. In both cases the skin assumed a marbled hue soon after death. Gazala kept a record of 160 cases of the second form of cholera. It began with frequent and

copious discharges from the bowels. These were at first mucous, but became afterwards muco-serous, and ultimately serous, with white flocculi floating in them. The evacuations, whether bilious or sanguineous at first, invariably assumed the serous character as the malady progressed. The patients suffered excruciating pain, caused by the cramps in the calf of the legs, in the abdominal muscles, in the muscles of the neck, and in those of the hands and feet. The patients had a peculiar expression, characterised by a fixed look; pale, contracted, immovable features; mouth half-open, nose pinched, cheeks hollow; lips, tip of the nose, and projecting parts of the face livid; eyes sunken deep in their sockets, and surrounded by a dark circle; cornea dull; pupil slightly dilated and almost insensible to the action of light. The patients had a stupid look, but their intelligence remained unaffected. The temperature of the body at this stage was a little above the normal standard; the pulse was frequent, small, and regular, 86 to 90 pulsations per minute; the respirations short and hurried, 24 to 30 respiratory movements per minute; the urine scanty and high-coloured, and the belly hollow. These symptoms became more marked as the malady progressed towards the algid state. The temperature would then fall in the axilla to 28°.C., and in the mouth to 30°, whilst that of the rectum, in the two instances that Gazala was able to take it, marked 37° to 38°. The extremities became cold and cyanotic, the fingers and toes shrivelled, and their tips and nails assumed a dusky hue. The pulse now ceased, first at the radial and then at the humeral artery. The sounds of the heart became indistinct, and its strokes irregular, 110 to 116 per minute. The superficial veins looked as if they were gorged with dark blood, and marked the skin with blue lines, which, together with the lowered temperature, gave it the semblance and the feeling of marble. Respiration became more frequent and more difficult; the urine entirely suppressed; and in many cases the patient became very restless. He would endeavour to get up, but would be obliged to lie down again as soon as he had made the attempt to rise He would remain quiet for a moment, and then try again to get up; but, after several such efforts, would ultimately settle down into an apathetic immobility resembling that of a corpse. The indications of asphyxia now became more apparent, respiration became slower and more irregular, somnolency came on, and death finally closed the scene.

This form of cholera and the suddenly fatal one already

described were met with chiefly whilst the epidemic was at its climax.

The third form of cholera observed by Gazala, and of which he has kept a record of 230 cases, was distinguished from the two other forms already described by the slowness of its development and the number of cases that yielded to medical treatment and recovered. Dr. Gazala noticed many persons affected with a painless diarrhœa, and who retained their strength and appetite throughout their ailment. He saw cases also in which this painless diarrhœa, after lasting for several days, would suddenly and rapidly increase in a few hours' time, weaken the patient very much, and finally end in a confirmed attack of cholera.

If an attack of cholera reached the stage of collapse without ending fatally, a new phase of the malady would set in. Warmth would return to the skin; the temperature would rise uniformly throughout the body, the pulse would begin to beat again, perspiration would come on, and would sometimes bathe the whole body, the cyanosis and the dark rim round the orbits would gradually disappear, the urine would flow again, consciousness would wake up, and the patient would seem to rouse out of a deep sleep. He would begin to speak, to notice objects around him, and would sometimes ask for food. At times, however, this promising reaction would be arrested, as if it had met with an obstacle in its progress. The temperature would not rise uniformly throughout every part of the body, and the extremities would remain cold, the nails and tips of the fingers and toes would still be livid, the pulse would beat irregularly, the urine would remain suppressed, the cramps would become more painful, and the patient would continue to be in an apathetic state, and betokening the danger of his condition. In from ten to sixty hours other nervous manifestations would then often declare themselves—restlessness, anxiety, delirium, hiccough, dry cough, nausea, contraction of pupil, tossing of the limbs—ending in death.

As Dr. Gazala was obliged to move about from place to place he could not follow up all his cases, more especially those that had become convalescent; but he saw many persons who had recovered from an attack of the malady, and the only sequelæ he observed in them were a want of strength and a tendency to dyspepsia.

Gazala asserts that those persons who had isolated themselves, and had taken precautions against the malady, were not smitten by it, whilst those who had previously suffered from malaria fever, from dysentery, or from diarrhœa,

were amongst the first victims to it. Most of the women attacked by the disease were either pregnant at the time, or had recently been confined. Strangers who had lately arrived at a place smitten with the outbreak, such as Indians and Persians, suffered more from it than those who had resided some time in the country. The huts which were dirty and crowded together retained the infection the longest, whilst those that were clean and isolated generally remained free from it. The outbreak usually lasted about a month in one place. A few cases of the malady occurred, however, after the outbreak was over, and showed themselves chiefly amongst persons recently arrived.

When cholera broke out at *Shatra*, in the middle of July, the weather was calm and dry. No rain had fallen in the Muntefik district during the winter and spring, and the marshes were quite dry. North-east winds prevailed, and the temperature was high, 30° to 45° C. Some persons, observes Gazala, believed that jackals and sparrows and other birds fled from a place smitten with cholera, and that fowls and donkeys have died with symptoms of vomiting during an outbreak. But he often heard the howling of jackals at night, and even called the attention to it of those persons who thought that these animals had left the place. At a later period, however, a friend of his who resided at Kérbela assured him that he had lost during the cholera outbreak there his two pet gazelles, and which had been, up to the moment of their sudden and fatal illness, in perfect health. They were seized suddenly with vomiting of blood, and died, one after the other, within forty-eight hours.

When the epidemic broke out in the Muntefik district the military doctor of Shatra declared it to be one of *pernicious fever* of a *choleraic type*, and many persons adopted this notion, and persisted in maintaining it. But the description of the malady given by Dr. Gazala, and its subsequent rapid and extensive diffusion throughout Lower Mesopotamia, can leave no doubt as to its having been one of *true epidemic cholera*. Some of the Bagdad medical practitioners, however, persisted in maintaining that it could not be true cholera, for neither *Shatra* nor *Detcheh*, where the outbreak had begun, were *seaports*, and cholera could not therefore have been brought there from India, and must have developed itself *spontaneously* in the Muntefik marshes. It was, therefore, a *cholera nostras*. But Dr. Gazala thinks the malady must have shown itself simultaneously in several places, and could thus be attri-

buted to an exotic source, and probably to Bombay. He had even heard that an outbreak had actually prevailed at Katif, a port on the Arabian shore of the Persian Gulf, previous to the Muntefik outbreak. Katif, he observes, is in constant communication with the Muntefik district, owing to the traffic carried on by horse-dealers between the two places. Dr. Lubicz confirmed this statement in his report addressed to the Constantinople Board of Health on the 25th of November 1889. He said that he had been positively assured that a severe outbreak of *cholera* had prevailed at Katif in May and June.

Dr. Lubicz describes Nasriyeh as a town containing eight thousand inhabitants, and situated on the left bank of the Euphrates, close to the spot where the river meets the Shat-el-Hai canal. The Mutessarif of Muntefik resides there. Most of its inhabitants live in huts constructed of reeds and matting, like those of Shatra; a few of them, however, live in huts built with sun-dried bricks. The outbreak, according to the official statement, began at Nasriyeh on the 1st of August with several attacks and two deaths, which increased, up to the 8th of August, to 85 deaths. They then began to diminish, and on the day of Lubicz's arrival (13th) had dwindled down to 19 deaths on that day. Lubicz found the town almost deserted. Some of its inhabitants had moved into huts outside the town, and some had taken refuge in the encampments of the neighbouring Arab tribes, whilst those who could afford it had fled far away in every direction. This circumstance, observes Lubicz, explains the rapid and extensive diffusion of the outbreak.

Lubicz found, when he arrived at Shatra and Nasriyeh, that Gazala had already burnt down most of their reed huts. He considered the destruction of these huts as an excellent measure to compel their inmates to disperse, and thus diminish the *foci* of the epidemic; yet, notwithstanding, the outbreak increased, and extended on the 3rd to Rumeitha, a village on the Euphrates half a day's journey from Samawa, on the 12th to Suk-esh-Shiukh, and on the 13th to Kurna, at the junction of the Euphrates with the Tigris, and to Hamar, a village on the left bank of the Euphrates, midway between Nasriyeh and Kurna.

Lubicz failed to obtain at Shatra and at Nasriyeh any clue as to the source of the outbreak. He makes the remark, however, that as the first case of it noticed at Bassora occurred on the 5th of August, and that town is said to have been healthy previous to that date, the

Muntefik outbreak looks as if it had had a spontaneous origin.

Lubicz quitted Nasriyeh on the 15th to return to Bagdad, and whilst on his way there was told by the Arabs that the outbreak had already extended over the whole region lying between Nasriyeh on the Euphrates and Kut-el-Amara on the Tigris. He arrived at Kut-el-Amara on the 19th, and found that a *cordon sanitaire* had been established there, on the 8th, to protect Bagdad and the country lying on the north of a line drawn from Samawa, on the Euphrates, to Kut-el-Amara, on the Tigris. This cordon extended from Samawa to Haï, Kut, Jesan, Bedra, and Zorbatia. The river traffic, moreover, on the Tigris, between Kut-el-Amara and Bassora, and that on the Euphrates between Bassora and Samawa, had been stopped by orders received from the Constantinople Board of Health. The freedom of the river traffic was restored again, however, on the 21st, but to the exclusion of passengers. In order to protect Bagdad against arrivals coming from Hilla, Kerbela, and Nejef, which were crowded with fugitives from Shatra and Nasriyeh, quarantine stations were established, on the 13th, at Musseyeb and Muhavil. A sanitary commission was, moreover, instituted at Bagdad under the presidency of the Vali, but cholera broke out next day (14th August) in Bagdad itself, and these quarantine stations then turned their restrictive measures against the arrivals from Bagdad, and put into quarantine all persons going from Bagdad to Hilla, to Nejef, and to Kerbella.

When the Sultan heard that cholera had broken out in Bagdad he ordered the cordons to be doubled, and placed at a great distance one from the other. Another cordon was therefore established, extending from the place where the river Diala quits Persian territory to Selahieh (Kifri), thence to Tuz-Khurmati, Yenijeh, and Tekrit on the Tigris, and thence to Hit and Cubeissa on the Euphrates. This cordon was intended to protect the country lying on the north of Bagdad.

Notwithstanding the outbreak of cholera in Bagdad, the quarantine imposed at Kut-el-Amara on arrivals from the south was maintained, by orders from the sanitary commission sitting at Bagdad. But all these restrictive measures did not prevent fugitives from Bagdad and from other localities going to Kerkuk, to Suleimaniyeh, to Mossul, and even to Anah on the Euphrates, nor did they prevent corpses (says Gazala) from being carried clandestinely to

the venerated Mesopotamian shrines for burial, in defiance of the existing prohibition.

The fugitives from Bassora, who were performing quarantine at Kut-el-Amara when Lubicz arrived there, and among whom cholera prevailed, were, by order of the Vali of Bagdad, put on board of the steamers *Khalifa, Baghdadi,* and *Mossul,* and sent back to Bassora. Cholera existed, however, at the time (August 19th) amongst the Arab tribes of "Beni-Lam" and "Kabiha", who dwell on the banks of the Tigris, and also in the towns of Baghala and Azizieh, situated on the Tigris, between Kut-el-Amara and Bagdad. It prevailed also at Jeziret, on the Shat-el-Amara (Haï) canal. On the 24th of August the quarantine of Kut-el-Amara was suppressed by orders from Constantinople, and Lubicz was then able to proceed to Bagdad where he found the inhabitants panic-stricken.

The outbreak had by this time expanded to a very great extent. Every place, from Fao at the mouth of the Shat-el-Arab to Kurna at the junction of the Tigris with the Euphrates, and all along the course of the Tigris up to Bagdad, was smitten with cholera. It had broken out, moreover, at Jezan, Bedra, Zorbatia, Mendelli, and Khanekin, towns on the Turco-Persian frontier, and at Zubeïr, a town situated to the south-west of Bassora; also at Kizilrobad, Shahraban, and Bakuba, on the left bank of the Diala, and at Kiazmiyeh on the Tigris, above Bagdad. But the outbreak had not, at that time, extended along the course of the Euphrates in a northerly direction beyond Musseyeb. On the 28th of August, however, cholera broke out at Saklawiya (Feluja) on the Euphrates, amongst a caravan which had reached that place by evading the cordon, but which was ultimately caught at Meskeneh (Balis) on the Euphrates, and compelled to perform a quarantine of fifteen days there. Ten fatal cases of cholera had occurred in this caravan within twelve hours, and whilst it was proceeding from Saklawiya to Ramadi, a place a little higher up the Euphrates, but none occurred afterwards, and it reached Meskeneh with the thirty-nine persons that composed it.

Owing to this untoward event the western limit of the cordon was moved up to Hit, on the Euphrates, above Saklawiya, whilst the cordon extending from Samawa to Kut and Zorbatia was also maintained, by orders from the Sanitary Commission sitting at Bagdad. This body, instead of attending to the sanitary requirements of Bagdad, occupied itself with cordons and quarantine measures. Its

example was imitated by the *Mutessarifs* and by the *Caïmakams* dependent on the authorities of Bagdad. But when the cholera broke out in their own districts, it was often overlooked until public attention was aroused by it.

The first case of cholera in Bagdad, according to the official statement, occurred on the 14th of August. But, on the 11th of that month, a servant of Yani Luca (says Lubicz) died from a severe attack of vomiting and purging, after a few hours' suffering, and, on the 13th, Dr. Mouradian announced to the Vali that a patient of his, a girl ten years old, had died with symptoms of cholera, after twenty hours' illness. The doctors who were sent by the Vali to verify the case declared, however, that it was *not* one of cholera. But, on the 14th, a Turkish soldier, whilst working in a spinning factory in Bagdad, was seized with vomiting and purging, and died in hospital, after six hours' suffering. This case was acknowledged to have been one of *cholera* by all the doctors who saw it, *excepting the Turkish military doctors* attached to the Sanitary Commission. Dr. Lubicz thinks that even these were not the *first instances* of cholera in Bagdad, and that it had existed, previous to the 11th of August, in the Arab quarter called "Bab-esh-Sheikh", inhabited by Arabs who are in continual intercourse with Shatra and Nasriyeh, and amongst whom there was a family that had fled from Shatra when cholera broke out in that place, and had arrived in Bagdad on the 6th of August by the steamer *Frat*, the very boat which had brought to Bagdad the successor of the Caïmakam who had died of cholera at Shatra, and who, shortly after his arrival in Bagdad, also died of cholera.

The outbreak had already decreased in Bassora and throughout Lower Mesopotamia at the date of the 27th August, owing perhaps to the dispersion of their inhabitants, but it was spreading in Upper Mesopotamia in a northerly direction, and a cordon was consequently established, stretching from Baba-derbend, midway between Kioy-sanjak and the Persian frontier, to Kioy-sanjak, Altun-Keopry on the Little Zab, and Elhamar, where the Little Zab meets the Tigris, and from this spot to Deir, on the Euphrates.

This cordon was no sooner formed than cholera broke out, on the 2nd of September, at Tessim, a village situated beyond the cordon, and close to Kerkuk. On the 4th of that month, a fatal case of it occurred in the military barracks of Selahieh (Kifri), and on the 7th, one in Kerkuk. The quarantine station at Selahieh was therefore

suppressed, as well as the cordon that had been established on the 18th August, extending from the Persian frontier along the Diala, to Kifri, Tuz-Khurmati, Yenijeh, and thence as far as Tekrit on the Tigris; and two new quarantine stations were created, one at Altun-Keopry and the other at Kioy-sanjak. The Constantinople Board of Health, however, at its sitting held on the 27th August, remarked that the cordons and quarantine stations did not keep pace with the march of the epidemic, for no sooner was a cordon or quarantine station established than the cholera would break out beyond their sphere of action. Dr. Lubicz made a similar remark in his report addressed to the Board of Health, on the 26th of October 1889, and said: "L'organisation des défenses ne pouvait pas marcher aussi vite que le fléau, qui dépassait toujours les cordons et stations quarantenaires." Mr. John Dickson, H.M.'s Consul at Damascus, reported on the 27th August to the Foreign Office, that, in consequence of the outbreak of cholera at Bagdad and at Bassora, the authorities of Damascus had imposed a strict quarantine on all caravans and travellers coming from the desert which lies on the east side of the province of Damascus, and had placed sanitary cordons to carry out this purpose at the stations where the caravans from Bagdad usually rested; "but", adds Consul Dickson, "the territory bordering on the eastern desert is so extensive, that it is impossible to cut off all communication with the province of Bagdad, and it is even predicted that, either before the end of this summer or early next spring, cholera will make its way into Syria."

When the Sultan heard of the outbreak at Kerkuk, he ordered that severe quarantine measures be taken to arrest its further progress. A cordon was therefore organised from Cubeissa-Hit on the Euphrates to Tekrit on the Tigris, and from this place to Elhamar, at the junction of the Tigris with the Little Zab; thence to Altun-Keopry, Kioy-sanjak, and Baba-derbend. At the same time, another cordon was extended from Deir on the Euphrates to Sheddadiyeh on the Khabur (tributary of the Euphrates), Tel-Kokeb at the junction of the Khabur with the Jaghjagha, Sinjar, Tel-afar, Hamam-Ali on the Tigris below Mossul, Kellek on the Great Zab, midway between Mossul and Erbil, Herir on a branch of the Great Zab north-east of Kellek, Amadiya on the Ghara (a tributary of the Great Zab north of Mossul), and Zakho on the Khabur (tributary of the Tigris), west of Amadiya.

Suleïmaniyeh was at that time free from cholera, and in

order to isolate it from the smitten localities, a cordon was extended from Altun-Keopry to Kafar, Billi, Tchemtchemal, Khanihava, Karadagh, and Païkuti, and thence up to the Persian frontier.

In the meanwhile the panic and mortality from cholera in Bagdad were increasing. When the malady broke out in one part of the city, the inhabitants of that quarter fled to some other part which was free from it; but they no sooner got there than cholera would show itself amongst them, and they would then rush back to the place from which they had come.

From the 24th to the 26th of August, inclusively, the deaths from cholera in the "Bab-esh-Sheikh" quarter of Bagdad had risen to 500 per diem, whilst the mortality from cholera throughout the remainder of the city did not exceed at the time 50 per diem.

When the stampede took place at Bagdad, and the inhabitants dispersed in the adjoining country, the deaths within the city rapidly decreased, and the local Sanitary Commission imagined that this was owing to the quarantine measures taken by them. Cleanliness and other personal precautions were attended to by the inhabitants to the utmost that their bewilderment allowed them to do; but no steps were taken by the Commission to clean the mosques, the Tekkeh (*oratories*), the public baths, and other public establishments, and to disinfect the public latrines. "It would have been no easy task", observes Lubicz, "to have cleansed in a short time and at a moment's notice a large city like Bagdad, reeking with dirt, and exhibiting heaps of ordure and decaying rubbish in its thoroughfares, and which must have favoured the development of the malady. The large sums of money expended for the protection of Bagdad by means of cordons and quarantine might have been more usefully spent in sanitary improvements within the city itself."

Dr. Bowman, in his report to the Deputy Surgeon-General of Bombay, dated Bagdad, September 14th, 1889, remarks that "the rapid decrease of the cholera deaths in Bagdad last week can neither be ascribed to a diminution of the population within the city—since large numbers of its inhabitants have returned to it—nor to any sanitary measures taken in it." Dr. Bowman follows up this remark by relating the following ghastly story. "The favourite burial-place of the Jewish community lies within the old city walls, and the Jews have continued to take there their dead for burial by paying heavy fees. Some Jews, how-

ever, to avoid these fees, resorted to various tricks: for instance, the body of a Jew who had died of cholera, out of town, was concealed unwashed in a *load of fresh vegetables*, and on arrival in Bagdad the body was deposited at a friend's house, and the vegetables taken to the market and sold." Another similar instance was that of a corpse put into a carriage, with an Arab head-dress well drawn over its face, and the corpse supported by two living companions, one on each side, and thus brought into Bagdad."

On the 6th of September cholera broke out at Selahieh (Kifri), and spread to the Zenghana, Dauda, and other Kurdish tribes. It broke out about the same time at Melha, a village beyond Kerkuk, and soon after in Kerkuk itself, where it caused, up to the 1st October, 490 deaths. It spread rapidly, moreover, throughout the surrounding country, and smote, on the 15th of September, the villages of Tuz-Khurmati, Yenijeh, Tauk, and Taza-Khurmati; and on the 16th Tekrit, Altun-Keopry, Hizarte, and Ridar, near Reshvan, on the Bastora-chaï, midway between Mossul and Revanduz. It also broke out in the quarantine station at the mountain pass of Leklek. On the 19th it broke out at Tchemtchemal, midway between Kerkuk and Suleïmaniyeh; and on the 20th at Hit and Cubeissa on the Euphrates. Cholera showed itself also, but in a mild form, amongst the Arab tribes of Dellim on the Euphrates, near Ramadi, and broke out, on the 14th September, at Hadisa, near Anah, the quarantine station of Hit. This quarantine station and that of Tekrit were consequently abandoned, and Deir on the Euphrates, and Elhamar at the junction of the Little Zab with the Tigris, were substituted for them. A cordon was, moreover, established, extending from the Persian frontier beyond Rayet, to Rayet, Revanduz, and then along the Great Zab to Hamam-Ali on the Tigris, and thence to Telafar and Sinjar, and ending at Deir on the Euphrates. To protect Syria, posts of observation were, moreover, established, on the 29th of September, at Carietein, a station on the road between Palmyra and Damascus, and at Meskeneh on the Euphrates, east of Aleppo.

On the 17th September cholera had almost ceased at Bagdad, and the Vali put a cordon round that city for the purpose of protecting it against arrivals from places where the malady still prevailed; and the Vali of Bassora applied a quarantine to all the pilgrims that came there from Kerbela and Nejef.

When cholera broke out in the southern districts of the

province of Mossul, on the 19th of September, the Vali of Diarbekir established a cordon, extending from Jeziret-ibn-Omar on the Tigris to Midyad, Mardin, and Mossul, for the protection of his province against arrivals coming from that of Mossul.

When cholera began to subside in Bagdad and in Bassora it broke out in places which had hitherto been spared by it, such as Shamiyeh, Nejef, Jihara, Kerbela, Hindiyeh, and other localities on the Euphrates. Amara and Hilla were also attacked, but this was not reported at the time, and when the fact became known the Sanitary Commission ordered a cordon to be formed for the protection of Bagdad against those places, but the matter having been referred to Constantinople this cordon was disapproved of and relinquished.

On the 16th of September a case of cholera manifested itself at Suleïmaniyeh, in Turkish Kurdistan, characterised by violent vomiting, frequent and copious purging, which assumed afterwards the rice-water semblance, pain in the belly and in the thighs and legs, cold perspiration, cold extremities, eyes sunk in their sockets, pulse thready, lips livid, great thirst, voice almost extinct, urine suppressed, patient apathetic. On the following day the pulse had ceased to beat, the vomiting and purging had stopped, the urine had not reappeared, and the patient died on the 19th.

Dr. Hambourg, the sanitary medical officer of Suleïmaniyeh, who relates this case of cholera, observes that it occurred eight days after the clandestine arrival in Suleïmaniyeh of two persons coming from Bagdad, and who had evaded the quarantine stations of Selahieh (Kifri), as well as that of Seghirma, close to Suleïmaniyeh, but he does not state whether these persons were affected or not with cholera at the time. On the 20th another fatal case of cholera declared itself in Suleïmaniyeh, and on the 22nd three other cases, one of which ended fatally. From the 16th to the 30th September, 63 cases of cholera were reported to the authorities, of which 39 proved fatal; but hardly any of the patients had received medical treatment, because the inhabitants of Suleïmaniyeh have a horror of doctors and of medicines. No stampede took place in this town. The climate of Suleïmaniyeh is very dry, and, in spite of the heaps of garbage and dirt accumulated in its streets, it is healthy. The outbreak of cholera ceased on the 22nd of November, and Dr. Hambourg says that from the 16th September to the 22nd November the avowed cases of cholera amounted to 386, of which 233 were fatal,

but that to these should be added about 20 cases and 12 deaths which were not declared. He rates the population of Suleïmaniyeh at fifteen thousand souls, and observes that this would give a cholera death-rate of 1.6 per cent.

The Jews of Suleïmaniyeh, remarks Hambourg, number about six hundred, and live out of town, in a suburb fifteen minutes' walk from Suleïmaniyeh, and separated from it by a plot of waste ground. No sooner had cholera declared itself in Suleïmaniyeh than the Jews shut themselves up in their suburb and stopped all intercourse with the town until the 26th of September, which was their New Year's day. On the 30th September cholera broke out amongst them.

From the 27th October to the 3rd November the temperature at Suleïmaniyeh fell from 24° to 18° C. during the day, and from 16° to 10° during the night, and the cases and deaths of cholera diminished. But no sooner did the temperature fall to 5° by day and 0° at night than they ceased altogether. Dr. Hambourg attributes, therefore, the cessation of cholera at Suleïmaniyeh to the fall of the temperature down to the freezing point.*

Cholera, according to Dr. Nicolaïdes, sanitary medical officer at Khanekin, a station on the Persian frontier, on the road from Bagdad to Kermanshah, broke out there on the 21st of August. In September it gradually subsided, and ceased on the 25th, but reappeared again on the 28th, after the arrival in Khanekin of some Persian pilgrims on their way to Mesopotamia. On the 29th September, however, rain fell in torrents, accompanied with hail, and the cholera disappeared suddenly from Khanekin, nor did it break out again notwithstanding the influx of pilgrims from Persia, where the malady was prevailing at the time.

On the 25th September, a death from cholera occurred at Altun-Keopry, and on the 30th, five cases of it at Kioy-sanjak. The quarantine stations at these two places were therefore suppressed, as well as the cordon established at Tchemtchemal for the protection of Suleïmaniyeh; but the cordon extending from Deir to Tel-Kokeb was maintained.

On the 3rd of October cholera broke out at Kamishtepeh, near Erbil (Arbela), on the 7th at Anah on the Euphrates; and on the 14th in Erbil itself, where it proved fatal to 115 persons in eleven days' time. The outbreak in Erbil rendered the cordon along the Little Zab useless. It was, therefore,

* In February 1889, six cases of vomiting and purging, ending in death, occurred at Suleïmaniyeh. Dr. Guth, who saw only one of these cases, characterised it as a case of *cholera nostras*.

moved up to the Great Zab, and installed from Rayet on the Persian frontier to Memehal, Dergala, Mavil, Revanduz, Coniatman, Kalakin, Herir, Guirdamamish, and Kelek; thence to Hamam-Ali, Tel-afar, and Sinjar. From this place the cordon was extended to Tel-cokeb, Sheddadiyeh on the Khabur, Deir, Buseira, Meyadin, Abukemal, along the Euphrates, and thence to Jubkawakib, where the roads leading to Aleppo and to Palmyra join. Besides this extensive cordon, with its quarantine stations at Revanduz, Kelek, Deir, and Abukemal, posts of observation were moreover placed at Amadiya and at Zakho, north of Mossul, for the protection of the country lying beyond Mossul, and a cordon was at the same time put from Jeziret-ibn-Omar to Midyad and Mardin, to protect Diarbekir.

On the 27th of October, cholera broke out in Revanduz, a town situated in a mountain gorge on the range which separates Turkey from Persia, and whose lofty summits are perpetually covered with snow. Revanduz has a population of four thousand souls. When Dr. Guth, the sanitary medical officer arrived there on the 7th of November, he found cholera prevailing in Revanduz, notwithstanding that the temperature was not high at the time. The Centigrade thermometer did not rise above 12° at noon, and it went down to 0° at night. "Cholera", observes Guth, "was brought to Revanduz from Erbil by a grocer named *Hama Emin*, who was smitten with it as soon as he arrived in Revanduz, and who died on the following day. His wife was then attacked with it, and after her his daughter, and after this the malady spread amongst the population. 112 cases and 106 deaths are said to have occurred from it in Revanduz.

On the 9th of November, cholera broke out in Mossul, and a military cordon was put round the city to prevent the exit of anyone from it. A cordon was moreover extended from Katun, on the Persian frontier, to Amadiya, Daudiya, Zakho, and Feishabur on the Tigris; thence to Tchelaha on the Hesawi (an affluent of the Khabur tributary of the Tigris), and ended at Deir on the Euphrates. The authorities of Zakho, Amadiya, Diarbekir, and Van, were ordered at the same time to repulse all arrivals from Mossul.

Besides the cordon at Meskeneh, Cairetein, and Deir, another one was established on the 16th of November from Orfa to Birejik, Harran, Raka, and Ras-el-ain, with a post of observation at Tadmur (Palmyra).

Cholera was prevalent in Bagdad, Suleïmaniyeh, Revan-

duz, Bakuba, Hindiyeh, Karkasyd near Altum-Keopry, Mossul, and Cubeissa, till the 11th of November, and on the 25th of that month a case of it occurred at Kiazmiyeh, a shrine close to Bagdad on its northern side.

On the 26th of November, the Constantinople Board of Health ordered that the *Kellek* (inflated skin rafts, upon which passengers and merchandise descend from Diarbekir to Mossul and to Bagdad) be stopped and inspected at Samarra, a station above Bagdad. This measure was intended to prevent cases of cholera being brought from Mossul to Bagdad, where the malady had ceased since the 28th of November, and it remained in force till the 28th of December.

On the 1st of December, Dr. Lubicz heard that an unusual death-rate had occurred at Hindiyeh, and at Shamiyeh on the Euphrates. Dr. Gazala was therefore sent to those places, and, on his return to Bagdad on the 15th of December, reported that towards the end of November ten deaths from cholera had occurred at Shamiyeh and one at Hindiyeh.

Cholera, according to Lubicz, ceased in Mossul after the 1st of December, in Suleïmaniyeh after the 22nd of November, and in Revanduz after the 9th of December.

On the 19th of December, the Vali of Mossul telegraphed to the Porte that cholera had broken out in the Kurdish district of Baradost, situated on the north of Revanduz. Thirteen cases, eleven of which were fatal, are reported to have occurred there. This outbreak had ceased on the 7th of December.

I shall now revert to the outbreak of cholera at Bassora. Dr. Vouros, the sanitary medical officer of Bassora, informed the Constantinople Board of Health that, on the 5th of August, a young woman who had arrived in Bassora a week before from Felia, a place close to Mohammera, a town on the Karun river in Persia, was suddenly taken ill with symptoms of cholera and died next day. Several fatal cases of cholera followed this one on the 7th and on the 8th August, and fifteen fatal attacks on the 9th. Up to the 12th August cholera prevailed only within the town of Bassora; but on that day cases of cholera occurred in the suburbs of Ashar and Macam, and on the 14th Mohammera and Felia were attacked by it. The inhabitants of Bassora, alarmed at the outbreak, fled from the town in all directions, thus disseminating the malady wherever they went. From Bassora and Mohammera the outbreak diffused itself along the course of the Shat-el-Arab and

Karun rivers. On the 19th a case of cholera declared itself at Fao, at the mouth of the Shat-el-Arab, and on the 22nd the sanitary agent there died of it.

The deaths from cholera in Bassora rose in the middle of August to 42 per diem; their number varied afterwards from 30 to 40 per diem for about ten days, and began to diminish after the 25th. They ceased for a week after the 4th October, but reappeared again and continued up to the 24th November, when they ceased altogether. Dr. Vouros says, 500 deaths from cholera were *registered* in Bassora; 458 during the month of August, 31 in September, and 11 in October. He thinks, however, that these figures are underrated, and that the mortality from cholera in Bassora, including the suburb of Ashar, must have reached a thousand, and would thus give a death-rate of 5 per cent. on a population reckoned at twenty thousand souls. He observes that all the first deaths that occurred from cholera were not made known to the authorities, partly from fear of having the huts and effects of the cholera patients destroyed by fire, and partly from an aversion to allow the bodies of their women to be examined. The stampede, moreover, that took place on the outbreak of the malady, prevented the registration of the deaths which occurred amongst the runaways.

Dr. Vouros is puzzled to account for the outbreak of cholera at Shatra, and disbelieves the idea that it came from Bassora. The endemic maladies of Bassora, he observes, are malaria fevers, dysentery, and ophthalmia.

Dr. Lubicz reckons that 7,261 deaths were caused in Mesopotamia and Turkish Kurdistan by the cholera outbreak of 1889.

Cholera had just broken out in Bassora when the Ottoman Consul at Bushir (a Persian port in the Persian Gulf) informed the Ottoman Embassy at Tehran that the British ss. *Mobile* had quitted Bassora on the 10th of August with more than fifty Persian passengers anxious to get away from that place, owing to cholera having broken out there; that the *Mobile* had arrived at Bushir on the 12th August, and was admitted at once to free pratique, but that during the voyage from Bassora to Bushir two passengers had died of cholera, and the body of one of them was landed at Bushir when the ship arrived there; that a passenger had died of cholera on shore, on the 13th, and four others a few days after this one; that cholera then spread in the town, lasting until the 23rd of August, when it ceased.

Dr. Camposampiero, Ottoman sanitary delegate at Tehran, states that cholera was officially announced to have broken out at Mohammera on the 20th August, and to have spread from that place to Ahwaz, Shuster, Dizful, and Khoremabad.

On the other hand, cholera had broken out on the 21st August at Khanekin, the Turkish frontier town through which the Persian pilgrims pass when on their way to and from their venerated shrines in Mesopotamia. It had broken out on the 26th at Serpul, Binkura, and Kirind, in Persia; on the 29th at Kasr-shirin, and on the 12th September at Kermanshah. On the 23rd September a severe outbreak was announced by Dr. Lubicz to have occurred at Hawizeh, a frontier Persian town, midway between Mohammera and Dizful. A quarantine station had been established by the Persian Government at Kasr-shirin for the protection of its territory, but this quarantine was so contrived that it did not hinder at all the traffic carried on between Persia and Mesopotamia.

As my purpose in writing this article is that of giving a short account of the outbreak of cholera as it occurred in the *Ottoman dominions* in 1889-90, and 91, I will now merely observe that cholera entered Persia in August 1889, from Turkey, through two channels, by way of Bassora and by way of Khanekin, and that it did not cease in Persia until the 20th of February 1890. From that time till the month of May 1892, no sign of cholera was noticed in Persia. But, whilst the cholera was raging in Mesopotamia and Persia in 1889, a severe outbreak of *bubonic plague* occurred in the Assir, a mountainous region of Arabia, lying between the Hejjaz and the Yemen. Plague appears to be endemic in that lofty mountain region, and breaks out there from time to time.

No satisfactory explanation having been given with regard to the source whence the wide-spread cholera outbreak of 1889 had derived its origin, the Constantinople Board of Health sent in 1890 a Commission, composed of Drs. Lubicz and Gazala, assisted by two Turkish military doctors, Ibrahim Bey and Mustafa Efendy, to visit Lower Mesopotamia and the Arabian and Persian ports of the Persian Gulf, and endeavour to solve this question.

The Commission went to Shatra on the 22nd of April, quitted Nasriyeh on the 28th, and arrived at Bassora on the 4th of May. It found the whole country flooded by an inundation of the Tigris and Euphrates.

Dr. Lubicz saw at Nasriyeh the mother of Ahmed, the butcher's son, who had died of cholera at Shatra on the

19th of July, and she confirmed the statement already given of that case, and said that her son was seized suddenly with vomiting and purging of a watery liquid, complained of intense thirst and great pain in the belly and legs, and his hands became icy cold. Her husband nursed the boy, and he died also a few days after him. Lubicz learned, moreover, from Haji Saleh, a wealthy grain merchant, that on the 21st of July, one of his men in charge of a granary outside the town of Shatra, and who at the time enjoyed perfect health, was suddenly seized with diarrhœa and vomiting, his eyes sank within their sockets, his lips assumed a dark hue, his voice became altered, and he kept drinking water incessantly, and died on the evening of that same day. But, added Haji Saleh, it was only on the 24th of July that the inhabitants of Shatra became aware of the existence amongst them of the "Abu-zuha" (vomiting sickness), the cholera. Khoja Haron, a Jew merchant of Shatra, told Lubicz that on the 26th of July he had written to his brother, who resided in Bagdad, not to send him any more goods, as he intended quitting Shatra in consequence of the manifestation of the " Abu-zuha" there.

The inhabitants of Shatra maintained that the "Abu-zuha" had come to them from Detcheh, a small district three hours off, in the direction of Nasriyeh, and that it had been brought to Detcheh by the Sadun Arabs from beyond the Euphrates. The Commission went to Detcheh, and was told that the Sadun Arabs had arrived there at harvest time, twenty to twenty-five days before the Curban Baïram (7th August), and that they had no sickness amongst them; their camels, however, had suffered very much on the other side of the river from want of pasture. The vomiting sickness, they added, existed already in Detcheh when the Sadun Arabs arrived there. It had prevailed at first amongst the children, and had come from God.

Detcheh, in ordinary times, has no intercourse with Shatra or Nasriyeh; but the canal and the marshes having dried up in 1889, the traffic between Shatra and Nasriyeh went through Detcheh.

The 1st of August is the official date of the commencement of the outbreak at Nasriyeh. This would make that outbreak subsequent to the one of Shatra, whereas the Commission found that cholera had broken out at Nasriyeh before doing so at Shatra. According to Sheikh Tamur Bey, a Sadun chief who resided at Nasriyeh, the vomiting sickness began there three or four days before the day on which the garrison quitted the town to camp out in tents.

This move occurred on the 14th of July, and would, therefore, place the date of the commencement of that outbreak at, say, the 11th of July. Yusuf Efendy, superintendent of the telegraph station at Nasriyeh, and who had resided there eight years, stated to the Commission that fevers of a malignant type prevailed at Nasriyeh in 1889, and obliged him to quit the place on the 26th of June in consequence of having suffered from them. There was no mention at that time of either diarrhœa or vomiting, but on his return to Nasriyeh in the beginning of July, he found that fatal cases of diarrhœa and vomiting were occurring there, and were attracting everybody's attention. All the chief *employés* of the Government had already quitted the place whilst the fevers prevailed, and those who had taken their places had now to do the same thing in consequence of the manifestation of the vomiting sickness. The first deaths from diarrhœa and vomiting that came to his knowledge occurred on the 4th July, and were soon followed by other similar cases. Yusuf Efendy quitted Nasriyeh for Bagdad on the 20th of July; remained at Shatra until the 23rd; and on resuming his journey caught the fever and had to stop at Kalasker. Whilst staying there, he heard on the 26th that cholera had broken out at Shatra. Molla Hussein having died of the vomiting sickness at Nasriyeh, his wife, Fatima, went on the 21st of July to her father, Molla Jevad, who resided at Suk-esh-Shiukh, where she fell ill with the vomiting sickness and died on the 24th, after eighteen hours' illness. Molla Jevad, who made this statement to the Commission, had resided in Persia, and had witnessed two outbreaks of cholera there. He described the symptoms that characterised the malady of Fatima, and which were similar to those of the cholera patients he had seen in Persia. No other case of cholera, added Molla Jevad, occurred at Suk-esh-Shiukh until the 11th of August, when fugitives from Nasriyeh began to arrive there.

Dr. Lubicz was told at Bassora that, previous to the manifestation of cholera, a fatal outbreak had prevailed there, and throughout the territory through which the Shat-el-Arab flows, but no one could give him a clear description of the character of the malady. He supposes it must have been an outbreak of malaria fever, complicated with dysenteric, bilious, and other intercurrent manifestations.

On arrival at Bassora the Commission discovered that cholera had prevailed amongst the "Khawat-Rhazna" Arabs, who squat outside the town of Bassora, previous to

the official date of the commencement of the outbreak in Bassora, viz., the 5th of August. These Arabs stated to the Commission that they had suffered severely from fevers in the beginning of March, and up to ten to fifteen days before Curban Baïram (23rd to 28th July), when the "Abu-zuha" appeared amongst them, characterised by vomiting and purging, pain in the belly and in the legs, intense thirst, and cold hands and feet. The patients wasted away rapidly, but did not lose their consciousness, and died in a day or two.* The notion, however, which prevailed amongst the inhabitants of Bassora, was that cholera had been brought there by Rauf Efendy, who had come from Shatra in a boat on the 4th of August, and lodged in a house opposite the one in which lived Mahameh, the young woman who died of cholera on the following day. But Mejid Efendy, a clerk in the Sanitary Office of Bassora, told Lubicz that two months before the commencement of the cholera outbreak, the mother of Ahmed Bey, an *employé* in the agency of the Oman steamers, and the daughter of policeman Hussein Efendy, and the mother of Halil Aga, a captain in the Redif (reserve troops), were reported to have died of cholera, and that he had mentioned this circumstance at the time to Dr. Vouros, the sanitary doctor, and to Dr. Browsky, a medical practitioner of Bassora. Mejid Efendy added, that he is certain that cholera existed at that time in Bassora, and that the medical practitioners (with the exception of Vouros, who was ill at the time) were aware of it, but did not divulge the fact through fear of displeasing the authorities. Lubicz quotes, moreover, the following cases recorded by Dr. Browsky, and related by him in a letter addressed, on the 26th of September 1889, to Dr. Greenfield of Bagdad, and which show that cholera had broken out in Bassora long before its manifestation at Shatra. Dr. Browsky mentions the death from cholera of a young negro in the service of Hidayet Pasha, governor-general of Bassora, followed by that of Ahmed Bin Mohammed, a regimental saka (water carrier), who died of cholera in the Naval Hospital of Bassora, on the 30th of June. This man was taken ill on the evening of the 29th with diarrhœa of a watery character, vomited twice, and then fell into a state of collapse. When taken to the hospital he complained of intense thirst, and a burning pain in his stomach; his extremities were cold, and his eyes surrounded by a dark areola. He died next morning,

* Khawat-Rhazna are labourers who come into Bassora daily, to gain a livelihood. Their women are nearly all of them prostitutes.

On the 5th of July the military doctor, Binbashi Selim Efendy was seized with diarrhœa, followed by a sensation of intense heat in the belly, prostration, cold extremities, cramps in the limbs, and cessation of the pulse. He then vomited several times and complained of great thirst, his fingers and nails assumed a violet hue, and he died during the night.

Lubicz made enquiries of Dr. Ahmed Bey, the principal naval medical officer there, concerning these two cases of cholera, but Ahmed Bey gave evasive replies, and pretended that they were cases of *pernicious fever*.

Besides the above instances quoted by Dr. Browsky, Lubicz was told by Yanco Rosso, a Greek tobacconist, that whilst he was on board of the ss. *Arabia*, on a voyage from Bushir to Bassora in July 1889, he noticed that the bodies of three Indian pilgrims were thrown overboard, and was told that they had died of *cholera*. This fact, added Yanco Rosso, was concealed from the sanitary doctor of Bassora, when the *Arabia* arrived there on the 11th of July, so that the ship should not be detained in quarantine longer than the twenty-four hours imposed on healthy arrivals from India.

Dr. Lubicz visited Fao and the villages scattered along the right bank of the Shat-el-Arab, all of which had been smitten with cholera.

On returning to Bassora, Lubicz parted from his companions, and went alone to visit Mohammera first, and then Bushir. He describes Mohammera as a wretched town, half in ruins, and with a fixed population of about two thousand five hundred souls, and a floating one of about ten thousand Arabs, living in tents, and belonging to the tribe of Felia. Mahameh, the young woman who died of cholera at Bassora on the 5th of August, was a native of Mohammera, and belonged to the Arab tribe of Felia; but she lived with her mother and brother at Bassora, and only occasionally came to Mohammera on a visit to her relatives.

Mohammera suffered severely from fevers before the outbreak of cholera, and Mr. Pritsche, agent of the Persian steamers at Mohammera, told Lubicz that on the 10th of June, a week after his arrival there in 1889, he went out for a walk, and was horribly disgusted at finding the banks of the river everywhere strewn over with patches of liquid human excrements. This sight made him vomit, and he suffered afterwards from diarrhœa, thirst and great weakness for two days, but ultimately recovered his health by taking chlorodyne.

Cholera, says Lubicz, broke out at Ahwaz on the 14th of August, after the arrival there of panic-stricken fugitives from Mohammera and Bassora.

The inhabitants of these districts, observes Lubicz, perform annual ziyarets (devotional visits) to the venerated shrines of Kerbela and Nejef, and, moreover, send their dead there in boats by way of Bassora, and in charge of mumeyiz (special trusted agents), to be buried in those consecrated localities.

A river traffic is carried on continually between Bassora and Nasriyeh, besides the overland intercourse kept up by the Arabs between these two places. As few pilgrims can afford the expense of going up to Bagdad by the Tigris steamboats, most of them proceed to Kerbela and Nejef by way of the Euphrates in barges, which sail or are towed up the river as far as Nasriyeh. These boats are often laden with dead bodies, and they avoid stopping at any place between Bassora and Nasriyeh, in order to avoid the robbers that infest the neighbourhood of Medina, Hamar, and Suk-esh-Shiukh. These barges are obliged to stop at Nasriyeh to pay their taxes and replenish their store of provisions.

During the year 1889, 545 corpses passed through Bassora for such purpose. 538 of them came from Persia, and seven from India. Those from India were enclosed in hermetically-sealed coffins. 409 of the corpses passed through Bassora in the month of April.

On his arrival at Bushir, Lubicz found by the records in the British Consulate, that it was the ss. *Mobile* that took cholera to Bushir. It had left Bassora on the 11th of August with 57 passengers, and arrived at Bushir on the 13th. Two deaths from cholera occurred on board during the passage, one of them at the moment of the ship's arrival at Bushir. Only ten attacks of cholera occurred in Bushir, and eight of them declared themselves on passengers that had come from Bassora. Another steamer, the *Kilwa*, quitted Bassora during the height of the epidemic there, and arrived at Bushir on the 15th of August, bringing many passengers, among whom cholera prevailed. Cholera, however, did not spread, and, excepting a few isolated cases of it at Dewis, at Shah-Abdullah, and at Hindian, small ports in the Persian Gulf, where the malady was brought by sailing craft from Bassora and Mohammera, no other place along the Persian shore of the Persian Gulf was attacked by it.

Dr. Gazala, accompanied by Dr. Mustafa Efendy, visited

Manamah, the principal port of the Island of Bahrein, Katif, Hasa, and Ajeir, and returned to Bassora by way of Kweit, Fao, and Zobeir. They were told at Manamah that fatal cases of vomiting and purging had frequently occurred there during the year 1889, and that in the month of June two steamers came from Bombay. One of them landed passengers, amongst whom there were sick persons suffering from vomiting and diarrhœa, and the other landed the body of a passenger who had died on board. Intercourse between Bahrein, Katif, Kweit, and Bassora, observes Gazala, was not interrupted all the while that cholera prevailed at Bassora and in Mesopotamia, and cases of cholera were brought to Manamah and to Katif by sailing vessels, but no case of it was noticed amongst the inhabitants of those two places. Cholera, adds Gazala, broke out, however, at Kweit, in the beginning of August 1889, and was brought there from Bassora.

Hasa is the name given to a district containing some inland villages lying between Ajeir and Katif. Zobeir is a stone-built town of 15,000 inhabitants, situated to the west of Bassora, at a distance of three hours.* The maritime traffic between Bahrein, Katar, Katif, and Kweit, is carried on by sailing vessels, and that between Bombay, Bahrein, Bushir, Fao, Mohammera, and Bassora, by the British India Company's steamers.

From the information gathered by the Commission, it appears that a malady of an undetermined character had prevailed at Bassora and throughout Lower Mesopotamia previous to the manifestation of cholera, and that nearly everybody at Shatra had then suffered from *diarrhœa*, a circumstance which, observes Gazala, does not occur with outbreaks of either typhus or malaria fever. Cases of cholera may, therefore, have been mistaken for cases of malaria fever. Lubicz, moreover, remarks that he doubts that pernicious fever could have been so fatal at Nasriyeh as to have caused in one day, on the 9th of July, the 17 deaths attributed to it. Cholera, besides, seems to have prevailed amongst the Khawat-Rhazna Arabs at Bassora before it broke out at Shatra, and to have declared itself in the Muntefik at harvest time, when the Bassora Arabs went into that district to reap the corn.

The traffic between Bassora and Bombay, observes Lubicz, is carried on by a good many sailing vessels, and by a weekly line of steamers. The Bills of Health which

* An hour's distance is usually reckoned at three miles.

were delivered by the Ottoman Consul at Bombay in the months of April, May, and June 1889, showed increased activity of the cholera at Bombay. Indian pilgrims came to Bassora from Bombay during that period, and fatal cases of cholera occurred on board ship, whilst on their passage from India to the Persian Gulf.

The Commission, taking into consideration all these facts, is led to infer that Bassora was the starting-point of the Mesopotamian cholera outbreak of 1889, and that the malady was brought there from British India.

Dr. Lubicz discards the notion of the horse-dealers having been the vehicle of this importation, because cholera already existed in Bassora previous to the return of the horse-dealers from India.

ON THE RECENT OUTBREAK OF CHOLERA IN PERSIA.

REPORT by DR. CAMPOSAMPIERO, Ottoman Sanitary Delegate at Tehran, to the Constantinople Board of Health.

Summarised and reported to the Epidemiological Society by DR. E. D. DICKSON, Physician to the British Embassy at Constantinople.

CHOLERA came into Persia in 1892 by two ways: from Afghanistan and from Russian Transcaucasia. The outbreak had its source, however, at Hurdwar on the Ganges, where it had broken out with great violence amongst the pilgrims assembled there in April 1891. The outbreak spread rapidly from Hurdwar to Cashmere, and thence to Afghanistan, and appeared in December at Jellalabad. From this place it extended to Cabul in 1892. The mortality it occasioned in Jellalabad and Cabul is said to have been very great, and the malady spread to the north of Cabul.

On the 22nd of February 1892, the cholera broke out at Herat, a city said to contain 50,000 inhabitants. According to the statement given by a Persian doctor who was sent, at a later period, to Afghanistan, on a special mission of enquiry, the cholera outbreak lasted in Herat only ten days, and caused only eight hundred deaths. But Dr. Camposampiero was informed from other sources that the outbreak had lasted there until the middle of April, and had caused more than three thousand deaths. The panic-stricken population of Herat had fled from the city, and had spread the malady to wherever it went, and more especially along the Russian frontier of Turkistan and in the mountainous region inhabited by the Hezaris and other wild tribes.

The Persian authorities, deaf to the warnings and to the recommendations repeatedly given to them by the Tehran Board of Health, had taken no precautions whatever for the protection of their territory. It was only at a later period, and when the outbreak was spreading towards the west of Persia, that the Government organised a system of

defence which proved as useless as it had been tardily devised.*

Cholera spread from Herat to Saïr, Rosanak, Tirpulghabest, Kuzan, and Hafizalek, small Afghan towns situated along the road leading up to the Persian frontier, where it broke out on the 1st of May 1892, in the district of Turbat-i-Sheïkh Jam, situated at the south-eastern extremity of the Persian province of Khorassan. The malady was brought to Jam, the principal town of this district, by the Afshar tribe, and it lasted there from the 1st of May to the beginning of July.

Two choleraic waves issued from Jam. One of them took a northerly direction towards Meshed, and the other took an opposite one, leading to Kehriz, Khaf, and Assadabad. As regards the wave which took a northerly direction, cases of cholera showed themselves on the 5th of May amongst the hamlets at Tineh; on the 7th the malady appeared at Lengend; on the 9th at Kalenderabad; on the 11th at Sherifabad; and on the 15th May at Meshed. The distance from Jam to Meshed is 145 kilomètres, and the deaths from cholera that occurred in the intervening stations smitten by it are reckoned at 2,500. From the 15th to the 27th of May the cases of cholera in Meshed were mild, and this led the Persian authorities to suppose that the outbreak there did not actually begin until the 27th. But, according to the European medical practitioners of Meshed, the mortality arising from cholera in that city, from the 20th of May to the 20th of July, amounted to five thousand, and represented 30 per cent. of the attacks. The outbreak began to diminish after the 20th July, and would probably have soon ceased altogether had not the return to Meshed of its panic-stricken fugitives rekindled the outbreak in the city. It finally ceased, however, on the 29th of August, and the total number of its registered deaths amounted to 5,533.

The Persian authorities established, towards the end of June, a cordon for the protection of Nishapur and Subzawar, cities lying to the west of Meshed, on the road to Shahrud and Asterabad. But cholera had already broken out on the 18th June at Askabad and Uzun-ada,† and it appeared on the 21st at Nishapur. From this date the

* This consisted in restrictive measures of an arbitrary character imposed against smitten localities by one district against another.

† Askabad, Russian territory lying to the north of Kushan and Bujnurd. Uzun-ada, territory on the Caspian shore, near the mouth of the Atrek river. Camposampiero thinks that cholera broke out at Uzun-ada between the 10th and 15th June. It was not officially announced, however, until the 21st.

outbreak spread rapidly towards Tehran, whilst the whole province of Khorassan was already overrun by the malady. The sanitary posts of observation that had been established in various localities were now changed into *cordons sanitaires*, and entrusted to the highest bidder for them, and who managed them for his own profit. Orders were issued by everybody, but obeyed by no one.

In the meanwhile the outbreak extended to Sarrakhs, east of Meshed; to Kushan and to Bujnurd, north-west of it; and on the 12th of August it broke out at Asterabad, west of Meshed, and not far from the Caspian shore. It followed at the same time the caravan road leading from Meshed to Tehran, breaking out successively at Abbasabad, Miandeshst, Derighes, Damghan, Mezinam, Shahrud, Semnun, Aïvan-keif, Ahmedabad, and finally at Tehran, where it manifested itself at the end of July.

Dr. Camposampiero relates as an instance of the efficiency of *cordons sanitaires*, that when cholera prevailed at Meshed, the chiefs of the tribes of Bujnurd and Ghuskan, in the neighbourhood of that city, interrupted all intercourse between their camps and the infected places, and thus kept themselves free of the outbreak.

The Tehran suburb of Shah-Abdulazim, says Camposampiero, lies on the Meshed road, and is a resting-place for caravans arriving from Meshed previous to their entry into Tehran. Cholera broke out at Shah-Abdulazim on the 25th of July, on the arrival there of a caravan from Khorassan. The first cases of it in Tehran appeared on the 26th of July, in the quarter called Serghendesh, on the return to that locality of Nassir-ul-Mulk's family from a pilgrimage to Meshed. Dr. Camposampiero adds, that when this family reached the station of Aïvan-Keif it lost some of its members, smitten with the cholera that prevailed there at the time. The clothing of the persons who had died of cholera was taken to Tehran and washed in the stream which supplies Serghendesh with drinking water.* Next day cholera broke out in that quarter, and spread throughout the city and the villages in the neighbourhood. The

* Dr. Tjelepis, Ottoman sanitary agent at Kermanshah, observes that this city contains a population of 30,000 souls, of whom more than a thousand are Jews, who live in a separate quarter from that occupied by the Mohammedan population. Notwithstanding the detestable sanitary conditions of the city, not a single case of cholera occurred amongst the Jews. The only explanation Tjelepis can give of this singular fact is that the water made use of by the Jews is taken from wells sunk within their own houses, whilst the Mohammedans derived their water-supply from a dirty stream that passes from house to house, and from one extremity of the town to the other.

heights of Shimeran were next attacked, and on the 14th of August the town of Kazvin, which lies to the west of Tehran, and where the outbreak then stopped.

From the 15th to the 25th of August the mortality from cholera in Tehran amounted to 700 deaths *per diem*. On the 8th of September the outbreak began to subside, but the return into town of its panic-stricken inhabitants, who had fled to the neighbouring hills, caused a recrudescence of it from the 10th to the 17th of September.

On the 16th of August, H.M. the Shah returned from his excursion into the south of Persia with a retinue of 20,000 followers, and camped in the vicinity of Tehran, at a moment when cholera was raging within the city. All the Shah's retinue had enjoyed up to that time excellent health, but no sooner had H.M.'s followers communicated with Tehran, than five attacks of cholera, two of them fatal, occurred amongst them. The camp was therefore removed next day to Shirazstanik, at the foot of the volcanic cone of Demavend. On the 20th August, five deaths from cholera, however, occurred there, and notwithstanding the Shah's camp was protected by a cordon, 135 deaths from cholera occurred in it owing to the intercourse that was kept up by the camp with the neighbouring villages. Cholera ceased in Tehran on the 23rd of November, and is said to have occasioned a mortality of 10,000 on a population of 120,000.

The outbreak now took a southerly course, and smote the villages in the plain of Veramin, near Tehran, and the cities of Kum, Kashan, and Sultanabad.

Yezd is a city situated to the south-east of Ispahan. Cholera broke out in it on the 19th of July, yet the country surrounding it was, at the time, free from cholera, and the malady could only therefore have reached Yezd from Khorassan, where it was still raging. The outbreak of Yezd is, therefore, attributed to an importation from Turbat-i-Sheïkh Jam, where the malady still prevailed. But Khorassan is separated from Yezd by an extensive salt desert, which cannot be traversed by caravans in the month of July owing to the absence of fresh water along that track. Dr. Camposampiero observes that the journey, however, from Meshed to Yezd can be performed in three days on the back of a camel, and across the salt desert by way of Damghan, Anarak, Tandek, and Rishin, and that this had actually been accomplished by camel-men arrived from Damghan, where cholera prevailed at the time.

When cholera made its appearance in the south of Persia

it showed itself also at Hamadan. From Hamadan it spread to Khoremabad, Malayr, Nihavend, Devletabad, and Burujird, and among the tribes scattered over Luristan. At the end of October it spread to the district of Yaveh in the Irak-Ajemi, and on the 17th to Kermanshah, where it lasted up to January 1893. The outbreak spread from Kashan to Noshabad, Nassirabad, Murshikar, and Ghez, and on the 3rd of October to the city of Ispahan. It subsequently attacked Abadeh and Shiraz, penetrated into Seïstan, and stopped at Bender-Abbas.*

Isolated cases of cholera appeared in the province of Kerman towards the beginning of September, and were attributed to an importation from Turbat-i-Sheïkh Jam.

Cholera prevailed in June at several points along the road from Meshed to Tehran. It had also broken out at Ardabil, in the province of Azerbeïjan. The outbreak had, moreover, crossed the Russian frontier beyond the Caspian in the middle of June, and had broken out on the 18th of that month at Askabad, and then at Uzun-ada, on the Caspian. From this place the malady is supposed to have been carried across the Caspian by steamer to Baku, where it manifested itself on the 20th of June.† Baku had a population of 20,000 souls, half of whom fled to the surrounding districts on the appearance of cholera in that city.

On the 1st of July cholera broke out at Tiflis, the capital of Russian Transcaucasia, and on that very day the traffic by sea between Baku and the Persian ports of the Caspian, which had been stopped in consequence of the outbreak of cholera in Persia, was resumed, and a steamer belonging to the "Mercure et Caucase" Company quitted Baku for Enzeli, where it arrived on the 3rd of July. Enzeli, says Camposampiero, had been free from cholera up to the 2nd of July. The steamer come from Baku had thrown overboard the bodies of nine passengers who had died of cholera during the voyage. A few hours after the arrival of this steamer at Enzeli, six attacks of cholera occurred there, and on the 4th of July the malady declared itself at Resht.

The cholera outbreak in the province of Azerbeïjan, adds Camposampiero, appears to have been derived also from the Caspian shore of Transcaucasia, for, when the malady

* When cholera broke out in Seïstan a rumour reached Tiflis that *Taun* (the plague) had manifested itself there, but this rumour was never realised, and arose, perhaps, from a misapplication of the word *taun* to cholera.

† Another version attributes the importation of cholera into Baku to the arrival there, by sailing craft, of sixty Turcomans from Ghez, a Caspian port near Asterabad, and who had evaded the Russian quarantine station of Apsheron.

broke out at Ardabil at the end of June, it had already existed at Baku, and may have been brought from that place to Astara or to Lenkeran, Persian ports on the Caspian, and from thence have slipped imperceptibly into Ardabil, which lies close to them.

Cholera, remarks Camposampiero, spared no town or village in the provinces of Ghilan and Azerbeïjan. It prevailed at Resht and in the district of Lahijan, and then broke out at Rustemabad and at Menjili, and finally in the district of Talish. After manifesting itself at Ardabil it showed itself at Serab, and then at Tabriz, where it broke out on the 29th July, and from whence it spread to Maragha, Urmiah, Khoï, Sautch-bulak, and to the districts of Guerruz and Sulduz, and later on to Serdesht and to Korveh in Persian Kurdistan. It finally broke out in Bukian and Sakkiz, where it was still prevailing in the month of March.*

The cholera manifestation of Tabriz spread to Jemalabad, to Miana, and to Zenjan, which lie on the commercial road between Tabriz and Tehran, and stopped at Kazvin, where it had already prevailed.

Cholera was at Asterabad on the 12th of August. On the 18th of that month cases of it occurred at Bender-Ghez, a small port on the Caspian, and on the 19th at Khavanghé, near Asterabad, and at Meshed-i-ser, a port on the Mazenderan shore of the Caspian, where it did not show itself severe, but from whence it spread to Tush, Sari, Bulfurush, Rench, and Telarm, five districts of Mazenderan, in which it committed great havoc.

Dr. Camposampiero concludes his report by stating that the cholera outbreak in Persia of 1892-93 came from Afghanistan, and began at Turbat-i-Sheïkh Jam. It spread from thence to Meshed, to Tehran, and to other parts of the kingdom, whilst another choleraic wave went to Askabad and Uzun-ada, crossed the Caspian to Baku, and from thence entered again into Persia at Enzeli. He reckons the mortality occasioned by this outbreak in Persia at 100,000 deaths in a population estimated at 5,500,000. The outbreak followed in every instance the track of human intercourse. The deplorable sanitary conditions of Persia, and the numerous sources of infection left by the malady, lead Dr. Camposampiero to apprehend a renewal of the outbreak this summer.

* Cholera still existed, on the 15th May, at Tabriz, Sakkiz, and Bukian.

LOIMOGRAPHIA

AN ACCOUNT

OF

THE GREAT PLAGUE OF LONDON

IN THE YEAR 1665.

BY

WILLIAM BOGHURST,

APOTHECARY.

NOW FIRST PRINTED FROM THE BRITISH MUSEUM SLOANE MS. 349,

FOR THE EPIDEMIOLOGICAL SOCIETY OF LONDON.

EDITED BY

JOSEPH FRANK PAYNE, M.D.,

LATE PRESIDENT OF THE SOCIETY.

LONDON:

SHAW AND SONS, FETTER LANE.

MDCCCXCIV.

INTRODUCTION.

By J. F. PAYNE, M.D.

THE treatise, which is now, by the liberality of the Epidemiological Society of London, printed for the first time, has long remained in manuscript in the library of the British Museum. It is a contemporary account of the last epidemic of Oriental Plague in this country, generally known as the Great Plague of London. In presenting it to the public, a few words of introduction seem required to explain the importance of this record in the history of epidemics, and to draw attention to some of the interesting points which it raises for discussion.

Our knowledge of the epidemic of 1665 is based more upon the official records, and the observations of laymen, than on medical reports. The latter, indeed, are few and unsatisfactory, partly because not many physicians remained to observe the epidemic, and partly because those who undertook to discuss the subject were, with one exception, very incompetent. The one exception was Nathanael Hodges, of whose well-known work I will only say here that it is far from rendering the account now published superfluous. Our author, Boghurst, gives a view of the subject, in important respects, entirely opposed to that of Hodges; he enters more fully into detail, and though inferior in his manner of presenting the subject, he must, as it seems to the present editor, be pronounced more instructive as regards the matter of his treatise.

His theme, though remote from us in time, will never lose its interest for students of epidemics. The features of the disease as recorded in the seventeenth century have been reproduced with striking uniformity on many occasions in other parts of the world; and last of all, in this

very year we have accounts from the British settlement of Hong Kong which furnish most instructive points of comparison with the Plague of London in 1665.

The Writer.

In the first place we may give such information as can be obtained respecting the writer himself.

William Boghurst was an apothecary, keeping a shop at the sign of the "White Hart", in the parish of St. Giles-in-the-Fields. Like many apothecaries both then and in later times, he practised also as a physician, or rather, perhaps, as a general practitioner, prescribing medicines and selling them himself. Some notion of his professional status may be gathered from an advertisement which has been quoted by Mr. E. W. Brayley, in his edition of Defoe's *Journal of the Plague Year*, from the *Intelligencer* newspaper for July 31st, 1665.*

"Whereas, Wm. Boghurst, Apothecary at the White Hart in St. Giles-in-the-Fields, hath administered a long time to such as have been infected with the Plague, to the number of 40, 50, or 60 patients a day, with wonderful success, by God's blessing upon certain excellent medicines which he hath, as a Water, a Lozenge, etc. Also an Electuary Antidote, of but 8*d.* the oz: price. This is to notify that the said Boghurst is willing to attend any person infected and desiring his attendance, either in City, Suburbs, or Country, upon reasonable terms, and that the remedies above mentioned are to be had at his house or shop, at the White Hart aforesaid."

Such an advertisement was not, it should be remembered, at that time so unprofessional as it would be now. From other sources we learn that he was at that time 34 years of age and already married.

Beside the present treatise, Boghurst was the author of a long poem in English, entitled "*Londinologia, Sive*

* Mr. Brayley seems to have been the first to draw attention to Boghurst's MS. It was drawn upon by the present writer for the article "Plague", in the *Encyclopædia Britannica*, and by Dr. Creighton, in his *History of Epidemics*; and it is even alluded to by Haeser, in his *Geschichte der Medizin*, vol. iii. The proposal to print it was brought before the Epidemiological Society in the Presidential Address, Session 1893-4.

Londini Encomium, The Antiquities and Excellencyes of London," which also remains in MS. in the British Museum (*Sloane MSS.* 908, fol. 72-84). It shows the author to have been a most patriotic citizen, but would hardly repay quotation. From notes appended to this poem we learn that he died in London at the age of 54, and was buried at Ditton, in Kent. The notes give a copy of his epitaph at Ditton, which, as it includes all the other particulars that can be recovered about him, is here transcribed.

"Heer lyes Wm. Boghurst, citizen and apothecary of London, Sonne of William of the parish of Ditton [whose family are resident in this county]. He was an honest, just man, skillfull in his profession, and in the Greeke and Latine Tongue, delighting in the study of Antiquity; and plaid exceeding well upon the lute, which he took naturally. He left a sorrowfull widdow and six children, to whom hee afforded commendable Breeding. He died September 2nd, 1685, brought from London, according to his own desire, and heer buried."

Hoping, and indeed believing, that the tombstone eulogy was at least on this occasion well deserved, we leave the worthy apothecary and scholar and go on to speak of his book.

The Manuscript.

The manuscript consists of eighty-five leaves, small quarto, neatly written, and evidently prepared for the press. The facsimile of the original title shows its general appearance. There is no evidence that it was ever printed; though it has been thought that the whole impression ready for publication may possibly have been burnt up in the Great Fire which destroyed, as is well known, the stocks of most of the city booksellers. It has been suggested, by Dr. Creighton, that the name at the foot of the title, which is torn off, may have been that of the intended or actual publisher. But it is not recorded in a way to imply this, and I have not been able to trace any known printer or bookseller of the time whose Christian name was Edmund; and it may have been merely the autograph of a former owner of the MS.* In preparing the text

* See, also, Note at end of Introduction, p. xxii.

for publication, some difficulty arose as to how far the eccentric and variable spelling of the original should be retained. Some of the peculiarities of orthography evidently arose from ignorance (as "plauge" for "plague"): others were mere slips of the pen, and others were individual eccentricities which would not have been respected by the printer. It seemed best, therefore, to correct the spelling, for the most part, so as to agree with what was usual in printed works of the period. But a certain number of peculiarities, which seem to have been specially affected by the author, have been retained, and will serve to give some individuality to the diction. The punctuation and the capricious use of capitals have been freely corrected.

Still greater difficulty has been experienced in presenting in an intelligible form the numerous and complicated prescriptions of the old apothecary, obscured as they are by wrong spelling, by puzzling contractions, and by crabbed handwriting. It may be thought, perhaps, that this obsolete pharmacology was hardly worth reprinting; but, on the other hand, a precise contemporary record of the medical practice of our forefathers will always have an historical value, independent of its relation to a particular epidemic; and this historical interest rather gains than loses with the lapse of time. These portions of the work have been carefully corrected by reference to the *Pharmacopœia Londinensis* (edition of 1662), and to contemporary medical works. It is hoped that they have been made tolerably clear; but if some obscurity still remains, the reader will kindly remember that the blame must, at all events, be divided between the author and the editor.

Medical Value of Boghurst's Treatise.

This treatise contains undoubtedly the best medical account of the great epidemic, which has been preserved. In order to substantiate this statement, which constitutes the main reason for printing the document, it is necessary

briefly to speak of the other known medical treatises referring to the epidemic of 1665. The following list contains all which are in the possession of the editor, and appears to be more complete than any which has been published, though doubtless there are other works which have escaped notice. A few are referred to by Boghurst himself at the beginning of his treatise.

Books published during or immediately after the Epidemic (1665-6).

1. A Brief Treatise of the Pestilence. Collected by W. Kemp, M.A. 1665. 4to.
2. A Discourse of the Plague. By Gideon Harvey, M.D. 1665. 4to.
3. A Mite Cast into the Treasury of the City of London, a Discourse on the Plague. By Theophilus Garencières, Dr. in Physic. 1665. 4to.
4. *Loimotomia*, or the Pest Anatomized. By George Thomson, M.D. 1666. 8vo. (With a plate representing a post-mortem examination of a pestilential body.)
5. *Hygiene*, or a Discourse upon Air, with Cautionary Rules for the Preservation of People in this Time of Sickness. By Thomas Cock. 1665. 4to.
6. *Medela Pestilentiæ*. Theological Queries concerning the Plague; also Method for curing that Epidemical Distemper. (By Richard Kephale.) 1665. 4to.
7. *Golgotha*, or a Looking-glass for London, shewing the Causes of the present Plagues, with an humble Witness against the Cruel Practice of Shutting up unto Destruction. By J. V. (printed for the Author). 1665. 4to.
8. London's Deliverance Predicted; in a Short Discourse on Plagues in General. By John Gadbury (the Astrologer). Licensed August 25. 1665. 4to.
9. A Learned Treatise of the Plague, wherein the Two Questions: Whether it may be Infectious or no; and whether it may be shunned of Christians by going aside are resolved. Written in Latine by the famous Theodore Beza Vezelian. (Edited by Edward Percivall.) 1665. 4to.
10. London's Dreadful Visitation, or a Collection of all the Bills of Mortality from Dec. 27, 1664, to Dec. 19, 1665. By the Company of Parish Clerks of London. 1665. 4to.

11. Directions for the Cure of the Plague, as for Preventing the Infection, etc., set down by the College of Physicians. By the King's Majesties Special Command. 1665. 4to. (Preface dated May 25th, 1665.)

12. Directions for the Prevention and Cure of the Plague Fitted for the Poorer sort. 1665. 4to.

    Anonymous; but refers to Mr. Coniers, at the "Unicorn" in Fleet Street, probably an apothecary, and the author.

13. Several Choice Histories, etc., of the Plague. By Isbrandus Diemerbroick. Translated into English. Feb. 1st, 1666. 4to. (No translator's or editor's name.)

14. God's Terrible Voice in the City. By T. Vincent, some time Minister of Maudlin's, Milk Street. 5th ed. 1667. 8vo.

    [Though chiefly theological and devotional, contains the most striking pictures of the state of the city at the time which have been preserved.]

15. Defoe's Journal of the Plague Year, written by "a citizen who continued all the while in London," published in 1722, should also be mentioned, because, though a fiction, it gives a wonderful picture, founded on printed accounts, and possibly on oral tradition, of the epidemic. It has been suggested by Mr. E. W. Brayley and Dr. Creighton that Defoe may have seen Boghurst's MS., but this is purely conjectural, and there is nothing special to confirm it.

Beside contemporary accounts there are some notices written by eminent physicians some time after the epidemic, and by Hodges, Sydenham, and Willis.

16. Nathaniel Hodges' *Loimologia*, sive Pestis Nuperæ apud Populum Londinensem grassantis narratio. 1672. 8vo.

    This was translated into English by John Quincy, and published in 1720.

    A smaller tract in English was written by Hodges in 1666 (dated May 8th), with the title, "An Account of the Plague in a letter to a Person of Quality." It must have been published then, but is only known by a reprint in "A Collection of Scarce Pieces relating to the Plague in 1665," published in 1721, the original edition having, apparently, entirely perished.

17. Sydenham's account is contained in his *Observationes Medicæ circa Morborum acutorum historiam et curationem*, London, 1676, 8vo (Sect. II, Cap. 2), reprinted in the Latin and English editions of his works. It is unfortunate that this great observer saw very little of the Plague, since he left London at the

beginning of June, when the epidemic was little advanced, and did not return till its decline. As his practice was chiefly among the rich, it is probable that he saw very few cases of "the Poor's Plague", as it was called.*

18. Willis's account of the disease in his treatise, "De Febribus" (first published in 1659), found in the Latin and English editions of his works, is based upon the epidemics in the time of the Civil Wars. A short tract with his name, "A Plain and Easie Method for the Plague, written in 1666 by T. Willis, M.D.," was published in 1691, professedly from Willis's papers, but I have seen a copy dated 1666, and it must have been really printed then. It is of little moment.

19. Of foreign works on the Plague only one need be specially mentioned, which Boghurst has made use of in the theoretical part of his work, viz.:—

Isbrandus Diemerbroeck; Tractatus de Peste. 1st ed., Arnheim, 1646. 4to. 2nd ed., Amsterdam, 1665. 4to.

This, one of the most scientific works on Plague in the 17th century, is remarkable for a number of histories of cases, which give a more exact notion of the disease than any systematic account. It was regarded as the great authority on the plague at this time, and some few cases were, as mentioned above (13) translated into English.

Criticism of Plague Literature.

A few remarks will now be made on some of the above works, to show what relation, if any, they had to Boghurst's treatise. Kemp's treatise (1) is a mere commonplace compilation. The author seems to have been in medical practice, but gives no information as to the existing epidemic. Harvey's and Garencières' works are trivial catch-penny publications, intended to recommend the writers to practice. Harvey (2), writing about Midsummer, makes the unfortunate forecast that the present

* Of the one case which he reports from the beginning of May, he says he is uncertain whether it should be called plague or not; but since it lasted fourteen days, and there is no mention of buboes, it can hardly be so considered. The recorded mortality from plague at this time was very small (see Table at end).

epidemic portended no great mortality. Garencières (3) says: "the plague is one of the easiest diseases in the world to be cured, if it be taken within four hours after the first invasion; otherwayes and for the most part mortal." He dates his pamphlet September 14th, when the deaths were nearly 7,000 a week!

George Thomson (4) was a chemical physician, and claims great success for his method of treatment. He is the only writer of the time who gives an account of the *post-mortem* appearances of plague.

Cock's pamphlet (5) contains a strong protest, addressed to the Lord Mayor and the Aldermen, against the practice of shutting up infected houses. The rest of the book consists of cautions addressed to citizens returning to town. It probably appeared late in the year.

Richard Kephale (6) was a medical practitioner of some kind. Half his book is theological, half medical, containing a very fair though short account of the symptoms of plague from personal experience, which agrees in the main with Boghurst.

Golgotha (7) is a protest, in most unmeasured language, against the shutting up of infected houses. The writer was not a doctor, but probably a minister. He refers to medical tracts by Mr. Dixon and Dr. Middlethwite (Micklethwaite?), which I have not been able to trace.

Gadbury (8) deals chiefly with astrological matters, and pronounces that the month of October seems to promise well, which was doubtless suggested by the experience of previous epidemics, but hardly borne out. His most important statement is that he himself suffered from Plague at Christmas 1664, but recovered; and that his surgeon informed him he had many patients at that time with the same distemper; but few or none died, and it was kept quiet.

Beza's treatise (9) is theological, and intended to comfort the consciences of those who in such terrible epidemics sought safety in flight.

The collection of Bills of Mortality (10) furnish the most

authentic records of the progress of the epidemic, and have been used by all subsequent writers, especially by Defoe in his well-known narrative.

The Directions set down by the College of Physicians 11) are substantially the same as those issued in 1636 which were much fuller than any previously published. On this occasion, however, there is an appendix of *Chymical Medicines* for "those that were delighted only with such remedies".

The directions for the Poorer Sort (12) is an unofficial publication of somewhat the same kind.

The other publications enumerated call for no special comment till we come to the work of Hodges, which has always been accepted as the standard account of the epidemic of 1665. It will be instructive to compare it with Boghurst's work, first observing that among all the tracts already mentioned there is none which could have been of much use to Boghurst had he known them, and Hodges' book was evidently unknown to him, being published later; and it is therefore with justice that the apothecary claims to write from his own experience. Hodges gives a totally different account of the origin of the epidemic from that of Boghurst. He says it began with the introduction of certain packets of merchandise from Holland, which common fame asserted to have come from Turkey; and that the first deaths occurred in a house in Westminster (other accounts say with greater precision in Long Acre, and that the first sufferers were foreigners) at the close of 1664; and from there it spread through the city, just as in the next year a single spark caused a terrible conflagration. He also says that he saw a single case of plague about Christmas, which recovered.

Boghurst's account differs widely. He says that cases occurred at the close of 1664, and he was credibly informed that cases of plague had occurred for three or four years before in the parishes of St. Giles's or St. Clement's, St. Paul's, Covent Garden, and St. Martin's (cap. iv, p. 73).

The pestilence was checked by the cold of winter, but reared its head again in the spring; it crept slowly along from the west-end to the city, and through the city to the Eastern parishes (cap. iv, 90); also he says it did not spread from one centre, but fell on several parts at once, viz., on the Western suburbs, Southwark, Houndsditch, and certain places within the city (cap. iv, 92).

There can, I think, be no doubt that Boghurst's account is by far the more rational and probable. The gradual extension from east to west, is, as Dr. Creighton says in his *History of Epidemics*, clearly borne out by official statistics, and the point has been seized by Defoe in his reconstruction of the history. The statements of Hodges and others of the bales of cotton from Holland and so forth are not supported by any authentic data, and the mode in which the plague spread through the whole metropolis was not that which the theory of Hodges would require.

We should be led to conclude that the virus of the plague was in London for some years before, perhaps latent since the last epidemic, and now by certain circumstances, as has constantly been the case in the history of this strange disorder, stirred up into the extraordinary explosion of 1665.

In support of this view we may be permitted to give a brief retrospect of the history of bubonic plague in England.

History of Plague in England.

During the Middle Ages, though we often hear of pestilences, we have no authentic record of any outbreak of bubonic plague till the arrival of the great pestilence or Black Death in 1348. It is open to anyone to conjecture that some of the earlier mediæval pestilences may have been of this nature, but there is certainly no evidence of it. After this date, however, we have clear accounts of a succession of pestilences due to this disease, during the 15th, 16th, and 17th centuries. They are fully recorded (and

for the first time from original sources) in Dr. Creighton's *History of Epidemics in Britain.* The record shows the astonishing frequency and fatality of the disease. The authentic history of Plague in England, ending with 1666, is thus comprised within a period of about 300 years.

Passing over the earlier periods we come to the 17th century, which specially concerns us. The first great epidemic of this century was the terribly destructive one of 1603. It lingered on for some years, and even in 1609 the mortality was considerable. The second great plague was in 1625, causing great mortality, but almost limited to one year. The epidemic of 1636 was less destructive, but remarkable for its long continuance, considerable mortality being recorded every year up to 1647. After this year there was a sudden drop in the mortality, and the whole period of the Commonwealth and the Protectorate was practically exempt.* A few deaths are put down every year to plague, but the average hardly exceeded fifteen per annum, and the numbers are sometimes so small that it seems doubtful whether they had any significance whatever. Up to 1664 the recorded deaths continued to become fewer, and it must have seemed as if the great terror of London was finally disappearing. At all events, no one dreamt of danger. The proximity of plague at Amsterdam in 1664, and a few sporadic cases in London at the close of the year, may have caused some persons a little apprehension; but certainly no one expected that the epidemic would begin to show itself in May, take a sudden start in June, and produce, in

* The Puritans, not unnaturally perhaps, from their point of view, connected these events with political changes. Each of the great epidemics marked the accession of a new king, James and Charles; while the sudden decline coincided with the final overthrow of the Monarchy in 1648. Even Milton, pleading in 1660 for a "Free Commonwealth", speaks of "the frequent Plagues and Pestilences that *then* [in monarchical times] wasted this City, such as through God's mercy, we have never felt since." Perhaps, when leaving the city, five years later, to escape the pestilence, he may have felt confirmed in his reading of history. There are said to be extant some verses very doubtfully ascribed to Milton, in which the Plague of 1665 is spoken of as a divine judgment on the sins of Charles II. (Garnett's *Life of Milton.*)

the autumn months, a mortality beyond anything previously known in London. As Boghurst himself states, "all prognosticks were vain; and the prophets quite at fault" (p. 20).

The extraordinary fact which struck contemporaries, as it has later historians, with astonishment, is that just when the disease seemed to be spontaneously dying out it suddenly sprang up again in the terrible epidemic of 1665, only to decline almost as rapidly, and then to vanish altogether. Some (the *contagionist* school) believed like Hodges that it was imported from Holland. Others (the *localists*) like Boghurst, that it originated in the old poison still lurking in the soil. On looking into the question, we find that the same problem presented itself in other parts of Europe, and was everywhere solved in one or the other way by opposing schools.

Contagionist and Localist Explanations of Plague.

It has always been a question whether the repeated recurrences of plague in Europe were to be attributed to reintroduction of the virus from the East, or to a fresh reawakening of a virus already endemic. Hirsch strongly asserts the former view, but there is much to be said on both sides. It is hardly necessary to consider the extreme *localist* view, that plague originated *de novo* in the insanitary conditions of European cities. London in 1665 was no doubt, according to modern notions, a dirty, ill-drained, unhealthy place; but was not a sinner in this respect above all other cities. There have been, and are, thousands of places equally dirty, where plague has never been heard of; and even supposing that specific diseases can thus originate spontaneously from local conditions, there is a special infelicity in explaining, by conditions present in so many parts of the world, the occurrence of a disease so remarkably limited and local in its distribution. That these conditions supplied a highly favour-

able, and perhaps the only possible *soil* for plague, is undoubted; but they can hardly explain its origin. Cadaveric infection again, upon which so much stress has been laid, is a special favouring condition, but not the original cause. The burial customs of old London were doubtless exceedingly bad, but they remained practically unchanged till the present century, when plague had long since ceased. The epidemic of 1665 did not originate in the City, with its numerous churchyards crowded into a small area, but in the suburbs, where the graveyards, however badly arranged, were few and far apart. These questions, however, are too large for discussion here.

In favour of Hirsch's view, there are the facts that the disease came originally from the East, that a general succession of epidemics from East to West was often observed, and its recession in the 17th and 18th centuries followed inversely the same law. In England, for instance, epidemics were often preceded by outbreaks in Holland, notably in 1625 and 1665, when destructive epidemics had occurred at Amsterdam in 1624 and 1664. In England, too, the incidence of the disease on seaport towns was far more severe than on those inland; and it is extraordinary how much more frequently and severely the East of England, which was in communication with the Continent, was affected than the West. Edinburgh and Leith, Newcastle, Yarmouth, Norwich, and Colchester, are names which recur with terrible frequency in the history of the Plague, while the western ports, Bristol and Plymouth, though they suffered severely, were less frequently affected, and became free from the disease earlier; the last outbreak at Bristol occurring in 1645, the last in Plymouth in 1626 and then from a special infection. There is no improbability in supposing that the eastern ports were often affected from Holland, or elsewhere on the Continent, when the plague was prevalent there in an epidemic form. In the then conditions of locomotion a contagion could more easily be carried over a hundred miles of sea than

over the same distance by land. The infection of Yarmouth before London, in the autumn of 1664, is a striking fact.

With regard to this epidemic of 1665, there is much to be said in favour of an importation from Holland. That was, at all events, the official belief, for in 1663, and early in 1664, great alarm was felt as to this source of danger, the disease being then very destructive in Amsterdam and other Dutch cities. Late in 1663 a lazaretto was established at Moll Haven, and in June 1664, quarantine against Holland was definitely proclaimed, though probably not efficiently maintained.* It does not seem impossible that while the indigenous disease was smouldering on in a mild fashion an importation of fresh virus from a focus of epidemic intensity might be sufficient to start a new outbreak.

On the other hand, there are strong arguments in favour of a local origin of the epidemic from an endemic virus. The frequent succession of epidemics in England during three centuries, the connection of the great epidemics by a few sporadic fatal cases almost every year (if the Bills of Mortality are to be trusted), and the persistence of conditions favourable to the conservation of the infection, are facts not to be overlooked, especially remembering the undoubted tendency of Plague, even in countries where it is quite at home, to recur in periodic waves.

It seems probable that London still contained sufficient plague virus to start a fresh epidemic, when the local and temporary conditions were favourable. The only temporary conditions of this kind that we know of are: first, the rapid growth of population in London, which caused terrible overcrowding, and must have overtasked the ordinary measures

* See the series of papers called "*Remembrancia:* An Analytical Index to Records in the Archives of the City of London, 1579-1664." Published in 1878. The correspondence between the Lords of the Council and the Corporation is very curious: the central authority, as usual, advocating restrictions; the municipal authority, in the interests of trade, inclined to procrastinate. The declaration of war in February 1665 decided the question.

of sanitation; and secondly, the long drought in the spring of 1665, which is referred to by Boghurst. The importance of this latter fact has been explained by Dr. Creighton, in accordance with Pettenkofer's laws, but, on the other hand, the great plague-year of 1625 was remarkably wet. The question is still one for discussion, and may be left to the judgment of the reader, guided by the valuable materials which Boghurst contributes.

Mild and Malignant Forms of Plague.

Without pretending therefore to solve this difficult problem, I will point out one feature in the natural history of plague, only recently discriminated, on which our records throw some light. The disease Plague is clearly capable of existing in two forms, viz., the malignant epidemic form, communicable from place to place, and a mild non-febrile bubonic disease, rarely fatal and strictly endemic, not obviously transmissible from place to place. The latter form, *pestis minor*, or abortive plague, observed by Tholozan and others in the East, was recognised by the late Mr. Netten Radcliffe in his Reports and his article "Plague" in Quain's *Dictionary of Medicine*,* and probably has existed in other plague-countries without being regarded as true plague.

Now, in London we hear from Hodges and Gadbury (quoted above) and also from Boghurst, of cases of plague, *of which few or none died*, occurring at the close of 1664, as well as presumably in previous years. Probably, therefore, the few recorded *deaths* corresponded to a relatively large number of *cases* of the mild disease, set down as simple buboes, not as plague. If so, this affection would supply the missing link of continuity between different epidemics.

* See also *Transactions of the Epidemiological Society of London*, vol. iv, 362, and *Encyclopædia Britannica*, article "Plague", by the present writer.

Existence of the Virus of Plague in the Soil.

Another important question connected with plague is the possibility of its being either primarily or secondarily an infection of the soil. This appears to be clearly indicated by the older and recent reports of plague in India and China, where one definite fact alleged is the poisoning of underground animals, such as rats, before human beings are affected. Similar observations are not recorded in any English epidemic, possibly in no contemporary Continental records, though statements of these occurrences as *signs of a coming plague* are met with in some old writers, which are evidently traditional, and derived from other conditions and climates than ours, as is shown by the animals said to be affected.* However, the existence of plague virus in the soil is a well ascertained fact in some countries, and hence more than one writer has spoken of the disease as *miasmatic* as well as *contagious* (Liebermeister, in Ziemmsen's *Handbuch*, article "Plague", as a probable view; and, tentatively, the present writer in the *Encyclopædia Britannica*). Still, in a disease so clearly transmissible as plague, the virus must have an existence also above the soil, and cannot be, like that of ague, purely miasmatic.

Dr. Creighton, in his *History of Epidemic Diseases*, has, for the first time, definitely and clearly formulated the theory of a virus existing in the soil, and applied it, with the aid

* Thus Gilbert Skene, in his *Description of the Pest*, written in Edinburgh or Aberdeen in 1568, speaks of *moles* and *serpents* leaving the earth (animals certainly not met with in the streets of Scottish cities); Lodge (1603), of rats and *moles*. Hodges goes still further afield, speaking of *serpents, conies, foxes*. But these writers never say that they saw such things themselves. I cannot, therefore, agree with Dr. Creighton that these statements show actual observation of the same facts so often recorded in the East. The origin of all these traditional stories seems to have been the chapter of Avicenna's "Canon" (lib. IV, fen 1, tract iv, cap. 3), from which so many of the commonplaces about the signs of a pestilence, in the European Plague-books were derived; and which may well have been founded on original observations in Arabia or Persia. No such fact is mentioned by Boghurst in London, or by Diemerbroeck in Holland. The former affirms that no brute animals were affected.

of Pettenkofer's theory of soil-water, to explain the origin and spread of the London plague of 1665, as described by Boghurst, whose history of the epidemic hardly bears any other interpretation than that of gradual infection, either of dwellings or of soil.*

Boghurst's own views as to the origin of plague in the soil may be left to the appreciation of the reader, but some of his speculations are curiously like Pettenkofer's theories of soil-infection, allowing for the absence of definite scientific observation; as when he speaks (cap. i) of time being necessary to produce a mature fermentation in the earth, and the resulting effluvia being drawn out of the soil by dry and hot weather.

Relation of Plague to Fevers.

One other point seems worthy of notice, the relation of plague to the other "fevers", especially typhus or spotted fever. There is no doubt that typhus and other fevers prevailed largely (causing 5000 deaths) during the plague epidemic of 1665, as they had done elsewhere in similar conditions. The question is whether the fever turned into the plague, as some physicians, both then and later, have supposed. It is generally admitted that the aspect and general symptoms of the two diseases have much in common; but Boghurst denies the connection emphatically, saying, "that though plague is generally accompanied by fever, this is no essential part of it; there have been pestilences without a fever, or any signs of putrefaction,

* This view is singularly confirmed by recent observations reported from China; since it is alleged, on the authority of M. Yersin, that the bacillus met with in the bodies of plague-patients has also been detected in the soil. It is also affirmed that while in Hong Kong the epidemic broke out among the human population before attacking the rats, at Canton the epidemic broke out first among the rats; shewing, if true, that in Hong Kong the virus was recently imported, while in Canton it was endemic. It is curious to note that in Canton the population living in boats was unaffected, which is also stated by Defoe to have been the case in London in 1665. (*Brit. Med. Journal*, Oct. 6th, 1894, p. 786.)

and thousands have died of plague without any fever; and the remedies which do good in putrid fever are no use in plague" (cap. iv, etc.). He admits that many people had the spotted fever and plague together, and yet commonly lived! (cap. iv, par. 60). His statement that "all other diseases turned into the plague", seems a little inconsistent; but the same allegation has often been made, and since we know that the coincidence of two specific infections is a rare event, it seems likely enough that so powerful a virus as that of plague should overpower others. Boghurst also enumerates the prevalence of spotted fever, small-pox, and measles, as among the forerunners of a pestilence.

The relations in time of the "fevers" to plague were not constant. Ever since the decline of plague in 1648 (and perhaps before, but the records are imperfect) there had been a great mortality from fever, and this increased from 1658-9 onwards, so that during the fifteen years preceding 1665, in which the plague had all but vanished, the fevers were gaining ground. The mortality from fever in 1664, though high, was not above the average of seven preceding years, and it seems unreasonable to suppose that the prevalence of fever had anything to do with the sudden outburst of plague in 1665, or that there was anything approaching to a conversion of fever into plague, as some contemporary physicians believed. In 1665 a very large mortality from fevers is recorded, but this would only seem to show that the same seasonal conditions which fostered plague fostered fevers also. On the whole, the supposed change of one form of fever into another, or into plague, seems to have been an error, natural enough in the infancy of clinical diagnosis, but still an error; and the malignant epidemic plague was probably developed out of the mild endemic, which went on from year to year.

Considering that it is hardly more than half-a-century since three diseases so distinct as typhus, enteric, and relapsing fever have been clearly discriminated, it is not wonderful that two centuries ago the whole family of

fevers seemed, to even good observers, a sort of protean dance of misty forms, changing their shape under the influence of shadowy forces, like the "Epidemic Constitution."*

Only researches such as those which have been lately carried on in China by skilled observers are likely to bring this ancient disease within the ken of modern science, by isolating its living cause and studying the biology of the organism, both in and out of the body.

The following short chronological table of plague-years and mortality may be convenient for reference.

DEATHS FROM PLAGUE IN LONDON IN THE SEVENTEENTH CENTURY, ACCORDING TO THE BILLS OF MORTALITY.

1603 (epidemic) ...	33,347	1648	611
1609 (minor epidemic) ...	4,240	1650-1662 (average)	15
1625 (epidemic) ...	41,313	1663	12
1636 (minor epidemic) ...	10,400	1664†	5
1637-1646 (average)	1,500	1665 (epidemic) ...	68,596
1647	3,597	1666	1,998

MONTHLY MORTALITY IN 1665.

January	0	July	6,137
February	1	August ...	17,036
March	0	September ...	26,230
April	2	October ...	14,373
May	43	November ...	3,449
June	590	December ...	734

The above statistics are taken from *London's Dreadful Visitation*, and Graunt's *Observations on the Bills of Mortality*. They present some trifling discrepancies, due to their being presented in a condensed form.

* In the Weekly Bills of Mortality for 1665, "Ague", "Fever", and "Spotted Fever" are clearly distinguished; but in the statistics here referred to all fevers are put together. The whole may be seen in Dr. Creighton's *History of Epidemics*, p. 533.

† At the close of 1664 some cases of mild plague, with very few deaths.

NOTE.

IT has been suggested to me that the name at the foot of the title-page of this MS. may be that of Edmund Curll, the well-known (or notorious) publisher in the eighteenth century, and what remains of the surname so precisely corresponds with this interpretation, that I have no doubt it is the correct one. As, however, Curll was not born till 1675, and did not begin to publish till 1706, his name could have had no relation to the projected original publication; and, as suggested above, probably denoted merely ownership. If Curll ever intended to bring out the tract, it would probably have been during the panic about the Plague, in 1721; and of such publication there is no trace. As he dealt largely in MSS., he most probably sold this one to Sir Hans Sloane, with whose library it passed to the British Museum. The name "Curll" may perhaps have been intentionally torn out, as being of bad odour, and one that Sir Hans Sloane would not have been pleased to see on his books.

J. F. P.

λοιμογραφία

Or an Experimentall Relation of the Plague of what hath happned Remarkeable in the last Plague in the City of London. Demonstrating its Generation Progresse forerunning and subsequent Diseases and Accidents Condition Signes, Good and Evill Signes, Meanes of Preservation Method of Cure generall & Particular, with a Collection of Chaice and Tried Medicines for preservation and Cure by the practicall Experience and Observation

Of

William Boghurst

Apothecary in S^t Giles in y^e fields

London

Edmund 1666.

ΛΟΙΜΟΓΡΑΦΙΑ

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PREFACE.

TO THE READER.

HAVING collected a few scattered observations during my practise upon the Plague, which continued these eighteen months, viz., from the 7th of November 1664, to the latter end of this May last past, 1666, and some of my Acquaintance being desirous to see them; considering that none hath printed anything either since this Plague or that 40 yeare since (which I something wonder at); for those two or three bookes printed last yeare about the middle of the Plague or a little before, as Mr. Kemp's booke, and Gideon Harvey's, Mr. Garencière's, and three or four other small things, spoke nothing from experience.* Neither could they, for the Authors had not practized at all at that time or but very little, soe that they only discoursed a little upon plagues in generall, and gave a few directions of preservation and Cure. They wrote only Collections, Traditions, and Conceits, and the Colledge's booke* had nothing in it but a few directions for cure and cleanlyness to Magistrates, Searchers, Warders, etc., and a few odde medicines, inward and outward. That cure of Carbuncles they had out of Johannes Vigo his Opera Chirurgica (folio 62)†, which they appoint by burnings and defensatives, but it is altogether to bee condemned, as the ill successe of that way of cure have proved this yeare. Many able persons might have saved mee this labour, and have done it better, especially if they had not been timorous, and, like Foxes in a storme, run to the next borough. Among forraigne authors, Diemerbrooke the Dutchman deserves the greatest commendation.* In some things hee seemed too singular and credulous; hee hath, indeed, made a pretty bigge booke, and hath shewed a great deal of learning and reading and Experience alsoe, but hath filled it up with history and large annotations and multitudes of long, tedious medicines and Receipts. The rest, which is the Text, two sheets of paper would have held it. But I had much to say concerning this Plague which Diemerbrooke could say nothing

* For a notice of these books, see the list in the Introduction.

† *Works of Chirurgery*, by John Vigon. Eng. Trans., 1571, fols. 29-30.

of. Besides, many things fell out here cleane contrary to his doctrine and experience.

I have endeavoured to write with as much brevity as I could, though I could have writt much more of this disease, yet none of it superfluous. Neither have I suckt out of other bookes, but I confess I have been very much straitened in tyme, soe many businesses of other kinds having occurred, that I had noe more leisure than about half an houre in a day to write, soe that I have been neere three months penning this Treatise, which I could have finished in a fortnight had I been master of my tyme, and have found that true which Horace said of making verses, *Carmina secessum scribentes et otia quærunt.* If any thinke it had been more credit to have writt in Latin, I answer, there are soe many Latin authors already, though few that have writt particularly (and done it well) concerning the Plague, most of them haveing inserted a little among their other workes; and generally all follow one another like sheepe through a gap, and therefore it would only have beene taken for a thing of course, and not minded, besides it had not beene soe good for generall reading and sale, and many have a desire to bee satisfied in many things concerning the Plague, which doe not understand Latin. I have omitted many things which I had collected on this subject, because I would not bee too tedious nor render the booke deare and bigge. I have writt nothing from hearsay or from bookes or from the testimony of others or my owne conceit, but all and onely from experience and triall; and I had the more advantage to doe this, being not at all feare-full, but rendering my selfe familiar to this disease as to any other, whereas many because of their fearefullnesse came not to close practise, but stood shivering at a distance, and profited the less both themselves and their patients, and commonly lost their lives to boot.

CHAPTER I.

OF THE PLAGUE AND ITS CAUSE, WITH SOMETHING CONCERNING FORMER PLAGUES.

As Death which is stiled by Job the King of Terrors, soe all diseases the precursors of it are the fruits of the first curse denounced upon man for his apostasy and disobedience to God, and noe disease in the great Army of diseases which assault our life is more dreadfull and deadly than that of the pestilence; hence it hath gained the name of Death in the Chaldee Paraphrase and version of the Septuagint, the name of mortality among Ecclesiasticall writers and fathers of the Church, and hath retained this name in our own mother tongue. This Disease hath raged and made sad havocke in the world, sometymes more universally spreading itselfe through most places of the known earth, sometymes more particularly fixeing upon one City or Region.

Of universall or œcumenicall Plagues the most spreading and destructive that I have met with in History are these four. First that of Athens, which fell out in the Peloponesian War in the yeare of the world 3520, before Christ 428, described most fully by that eminent Historian Thucydides in his second booke, who had beene sick of it himself, but restored, and from him by that great promoter and enlightener of the Epicurean or Corpuscular Philosophy, the Poet Lucretius, in the last part of his last booke. This Plague, though it bee vulgarly called the Athenian Plague because it did great execution there in that City, yet indeed not on Athens alone, but as Thucydides tells us, beginning at Æthiopia, overran Affricke and transferred itself into Asia and thence into Europe.

The second furious or œcumenicall Plague which hath occurred in my Reading was in the Raigne of Vibius Gallus and Volusianus his sonne, according to Calvisius, in the year of the world 4302, of Christ 253. This Plague is also related to have its Originall in Æthiopia, and from thence to have diffused itself into all the Provinces of the Roman Empire, and to have lasted 15 yeares without intermission. How it raged in Alexandria and Ægypt wee understand from an Epistle of Dionysius, the bishop of that city at that tyme,

recorded by Eusebius in his 37th booke, Cap. 22. He tells us it fell promiscuously upon the Heathen and the Christians, though most heavily upon the former, that noe house was free from the dire effects of its rage. In other parts of Affrique wee understand from St. Cyprian, the bishop of Carthage, in his excellent sermon *de Mortalitate*, made on purpose to animate and strengthen the Christians who now joynt and fellow-sufferers with the Heathens *unde præsentis mortalitatis copia*, as hee tearmes it, large measure of the then mortallity proceeded. And of its rage at Rome, wee find observed out of the Roman History by Calvisius that there dyed of it dayly to the number of five thousand, and therefore Brightman and Mead, both men sufficiently learned, in their Commentaryes upon the Revelations interpret the plague to bee one of the fearfull Judgments foretold to breake forth upon the opening of the fourth Seale (Rev., Chap. vi, 8). And Justus Lipsius, a Critick of noe ordinary reading, saith of this Pestilence in his book *de Constantia*, lib. 2, *non alia nunquam major lues*, etc., that his reading did not afford him an example or precedent of a greater plague considering the many countries it infested or the severall yeares that it lasted.

The third universall Plague was that which happened in the Raigne of Justinian and tooke its beginning in the yeare of Christ 532, and this also as the former is sayd to have descended from Æthiopia. We have a copious description of it by Procopius in his *Persicorum, lib.* 2, and wee are informed by him that it raged very much in Byzantium or Constantinople for three months space, and that when it was in its height there dyed of it every day ten thousands and upwards; and this is the Pestilence related by Evagrius the Ecclesiastical Historian in his 4th booke, chap. 28, which lasted as he sayes 52 yeares, not continuall but by severall returnes and revolutions, and of this Pestilence hee was sicke himselfe, and had a rising in his groins. And Greece shared not only in the contagion of it, but also Italy, as wee reade in Paulus Diaconus, and it swept away Pope Pelagius, the predecessor of Gregory the Greate, about the yeare 580, for I conceive this Plague to bee that in the raigne of Justinian propagated into remoter Countryes and lengthened out to this terme much according to the forementioned computation of Evagrius. It also overran France in the yeare 583 and robbed King Chilpericke of two sonnes, and Guntheraund, King of another part of France, of his wife (see Calvisius in the year 583). And this I conclude to bee that which plagued the Britaines here in that vacation betwixt the

Romans Government and Saxons in Vortigern's tyme, when the living could scarce bury the dead.

The 4th œcumenical Plague which I have taken notice of was in the yeare 1347, *quæ violentissma fuit et totum mundum pervasit in annis sex. Ita vastavit ut ne tertia pars hominum superesset* (they are the words of Calvisius). It was most violent and ran over the world in six yeares, and soe wasted Europe that not the third part of men were left alive. To omitt other parts and see what it did at home in our owne Country, Mr. Cambden reports in his *Britannia* that in the yeare 1348 this plague was so hott that in Wallinford in Barkshire it dispeopled the Towne, reduceing their 12 churches to one or two which they now retayne. In London it had soe quick an edge that in the space of 12 monthes there was buried in one churchyard, commonly called the Cistertian or Charterhouse, above fifty thousand. They write further that through the kingdom it made such havocke that it tooke away more than halfe the people, and it is noted there dyed in London alone betweene the first of January and the first of July 57,374 (see Daniel in 22 Edw. 3).

Of the Particular Plagues (to passe by those in sacred story, as the death of every first born throughout the Land of Egypt in one night, the death of one hundred eighty-five thousand of Sennacherib's Army in the same Compasse of tyme,—to passe by these as supernaturall and miraculous), if wee looke into profane story wee shall find the Destroyer of mankind, the Pestilence, to have beene very remarkable in some countryes and cityes when there was noe universall Contagion, as that at Rome in the Consulship of Quintilius Varus and P. Curiatius Tergeminus, about three hundred yeares from the first building of the City, wherein, according to Livy, one moiety of the Inhabitants, one of the Consuls, Quintil. Varus, and four Tribunes of the people perished.

I might give other instances out of Livy, but I omitt them, and recite only one more of a Pestilence in that City in the Raigne of Titus the sonne of Vespasian, mentioned by Suetonius in the life of this Emperor, and hee sayth it was *Pestilentia quanta non temere aliam*, etc., such a Pestilence as wee shall not easily meete with a parallel, and Eusebius saith it was so great that for some space of tyme neere upon ten thousand dyed daily, as by their Ephemerides or Bills of Mortality appeared. And it is reported of Grand Cairo in Ægypt that it is visited every seventh yeare with a dreadfull pestilence, and that it is conceived to bee in good health if there dye not above a thousand a day, or 300,000 within the

yeare, as Heylin saith in his Geography. And these things I have layd downe as a lover of History, in Confirmation of that saying of Solomon (Ecc. i, 10), "Is there anything "whereof it may bee said, Loe this is new! It hath beene "already of old tyme which was before us?" That wee may more clearely see that good men have fallen under this common scourge of mankind as well as bad, *Quid enim in hoc mundo non commune cum ceteris quam diu adhuc secundum legem primæ nativitatis manet caro ista communis?* saith St. Cyprian to the Christians who stumbled at this piece of providence in his tyme (*Sermo de mortalitate*). Nay, good men have beene sooner taken away than bad, as it was at the Plague at Athens, *Διεφθείροντο καὶ μάλιστα οἱ ἀρετῆς τι μεταποιούμενοι*, those dyed most that had any goodness or vertue in them, saith Thucydides, because they looked upon themselves obliged, as it followes in the same Historian, not to fly and leave their friends, but to helpe them in their misery. And Dionysius informes us that the same fate attended the Christians in the Plague at Alexandria. "The "best of the brethren dyed because they did not separate "themselves, but sedulously administered to the sicke in "their necessityes." Hee that hath a minde to heare of more Plagues may reade a great catalogue of them in the latter end of Athanasius Kircher in his booke called *Scrutinium Pestis*, also in Diemerbrook his Booke of the Plague.

Now I shall make some short inquiry in the nature and causes of the Plague as a student in Physick; and as the essence and quiddity of all things, and soe of all diseases, are very abstruse partly in themselves and partly to our understandings, which with the Fox in the fable lick only the outside of the Glasse, as haveing noe intelligence but what they receive from the outward senses, which in most things are very dull and doubtful informers; soe among all diseases the nature of none is soe mysterious as that of the Pestilence, and therefore it is called by the psalmist the pestilence that walketh in darkness, *quia causæ ejus latent*, as Grotius saith, and this disease hath beene the more a Riddle to us because men's feares have made them strangers to it and fly it, at least hindred them from those narrow, accurate, and watchfull observations upon its motions, which are requisite for the beginning of knowledge; as Diemerbrook saith, "noe man had writt particularly of many things "happening in the plague before hee did, being frighted with "the Disease it selfe." That of Helmont is too true in his Treatise, *De Peste; ipsimet doctores et scribentes primo*

*aufugiunt.** The great Doctors and such as undertake to write about the disease are the first that run away from it, and soe as it followes, *omnis illorum doctrina fundamento putationis innititur*, and therefore all their learning about it can bee but opiniative and conjecturall. Now the first question that occurrs in Moderne Physitians about this disease is *an sit morbus totius substantiæ*, how properly the question is worded I shall not dispute, let that rest upon Fernelius, who was the first coyner of it, but their meaning is this, whether the Pestilence is *Morbus intemperiei*, a disease which proceedes from the excesse of some manifest quality as heat, moisture, or from some venomous quality, occult or unknowne to us which doth immediately prey upon the vitall spirits or principles of life, or, in a word, whether the disease may be reduced to some manifest quality or to some occult quality; and the latter writers, and those the most learned and juditious, generally agree in this, That the *Continens causa*, that I may use the words of Taurellus in *Methodo Medicæ Prædictionis;—nec putredo nec inflammatio sed occulta quædam et venenata vis*, neither the putrefaction nor inflammation of humors produced by the excesse of some manifest quality as heat, cold, moisture, etc., but the contagious influence of some peculiar poyson or venom, immediately seizing upon the heart and spirits. And this is the judgment of the learned Gregory Horstius in his *Centuria Problematum Therapeuticorum* (*Decad.* 10), and of Sennertus in his Treatise, *De Peste*, Riverius, *De febre pestilentiali*, of Saracenus, Valleriola, and Fernelius, *Omnis pestilentiæ cæca et delitescens est causa, et aliunde quam ex primis qualitatibus aut ex putredine profecta* (*De abditis verum causis*, lib. 2, cap. 12).

And those learned men, who will have the pestilence essentially and formally a fever, as they have been greatly divided among themselves in the explication of their opinion (as you may see in Horstius the place above quoted), soe they all greatly wandered from the truth, for there have beene pestilences without a fever or any signs of putrefaction. Wee receive it not only from the Testimony of Hippocrates in the third of his Epidemicks in sundry passages, and from the Testimony of Galen in his exposition of that booke, but from the experience of severall later physitians.

The effects of the Pestilence are soe strange and horrid, and raise such tragedyes, which cannot be reckoned meere effects of putrefaction, and of the exorbitancy of manifest qualityes.

Those remedyes which resist putrefaction and availe in

* Van Helmont, *Tumulus Pestis*, 1644, p. 5.

meere putrid feavers are insignificant and of noe value in the pestilence.

Soe that the Pestilence is not a bare putrid feaver, though wee may fancy it is putrefaction in the highest degree of exaltation, yet this must not bee denyed but that it is generally accompanied with a feaver, but this is not of the essence and constitution of it, but a consequent and effect flowing from it.

The essence then of the Pestilence is lodged in some peculiar venome that is contrary and destructive to the vitall principles of man. That this venome is a body or concretion of many little bodyes, though very subtle and invisible, can bee noe doubt for those that have outgrown Aristotle and are acquainted with the Epicurean or corpuscular philosophy; and for the nature of the pestiferous corpuscles and the manner of their propagation in the Air and humors of the body, light may bee had as from the Epicurean Hypothesis in generall, soe particularly from Lucretius in the end of his 6th booke and Gassendus in his *Philosophiæ Epicur. Syntag.* (cap. 17). But for the shape and figure of these Atomes or small bodyes, which is the foundation of their activity and of that power whereby they corrupt the texture, alter and change the motion of these corpuscles or particles which compose the spirits and blood, wee can say nothing to satisfaction; they fall not under the eyes' perception, though assisted with the best inventions in perspective wherein this last age hath furnished us with, or any other sense, and therefore wee may conclude with the words of Fernelius (*de abditis rerum causis*, libr. 2, cap. 12), "The seedes of the "Pestilence are soe hidden and removed from sense that wee "see them better in their effects than we can in themselves."

But another question there is, whence this venome or pestiferous corpuscles are derived, to what wombe do they owe their birth and originall, whether they are derived from the heavens or starrs, or secondly from some corruptions or Humors in man's body, and soe propagated from one to another, or thirdly from the Bowells or Cavityes of the Earth? As for the first, though it hath beene a catholique and received opinion among Phylosophers and Physitians that the malignant conjunction of some heavenly bodyes have by their influence infested the Aire and soe engendered the Pestilence, yet could I never understand from anything I have read in them the manner how. Yet let me adde thus much, that if we suppose the universe, according to the Cartesian Hypothesis, to bee made up of severall Vortices and every one of them to bee furnished with his peculiar Sun and

Planets or illuminated Earths, and if wee suppose a Comet to bee nothing but the conflagrations of one of these earths or Planets from the eruption of its central fire, perhaps some fumes arising from this Conflagration may insinuate themselves into the neighbouring vortices to the polluting and contaminating the aire; soe a comet may not only be a signe or forerunner as many would have it, but also the cause of a Pestilence. But if this conceite seems too romantique and fantasticall let it passe for such; for upon many considerations noe great weight is to bee layd upon it, yet it hath more of probability in it than the old received way of the Planets infecting and defiling the Aire.

For the Plague ariseing from the corruption of humors within us and soe spreading itselfe amongst others by contagion, though it bee asserted by Riverius (*de febre pestilenti*), by Pareus, and by Horstius (*Institut. Med. disputat.* 6, quest. 9), *humores in Corpore humano sæpius adeo corrumpi posse ut naturam veneni inducant*, And Horstius cites the Authority of Galen for it (libr. 6, *de locis affect.*, cap. 5, and in his Comment upon the third of the Epidemickes), yet hee explained it soe darkly that a criticall examiner of things can receive noe satisfaction from his explication; and how the humors of the body under the notion of being hott, cold, dry, or moist, or endowed with such other elementary qualityes should produce such horrid symptoms and effects as we find in such malignant diseases I cannot understand, for it seems to be wholly beyond the sphere of their activity. Venoms may bee gendered in us I dare not deny, and it seemes also to bee the Judgement of that great Ornament of the University of Oxon., Dr. Willis, who in his booke *De Febribus* (cap. 12, *De feb. malign. seu pestilentiali*), where speaking of venomes and the strong effects they produce upon the spirits and humors of our bodyes hee tells us of such venoms, "*sæpe in corpore "nostro gignuntur*, they are often engendered in our bodyes." And that illustrious Virtuoso Mr. Boyle, in his Usefulness of Experimentall Philosophy (Part 2, Essay 2, page 40) tells us that a very eminent person complained to him that in the fitt of a distemper, which almost as much puzzled her physitians as herselfe, she sometymes vomitted up something so sharpe and fretting that after it had burnt her throat in its passage almost like scalding water; it did not only staine the silver vessels that received it, but also did work upon them as if it had beene a corrosive menstruum. And the same honorable person a little above (page 36) leads us into the discovery of the cause of such stupendious effects in the body. I shall give you his owne wordes.

"Though I am unwilling to meddle with medical contro-
"versies, and am apt to think that Chymists are apt to speak
"somewhat too slightingly of the humours of the humane
"body and allow them too little a share in the production of
"diseases, yet (to skip other reasons) the strange stories
"related by Skenkius and other eminent physitians of the
"corrosiveness of some juices, which rejected by urine or
"vomits, have beene able to boyle on brass, fret linnen, and
"staine silver; together with some odd observations of this
"nature ourselves have had opportunity to make, doe very
"much incline us to believe, that the generality of former
"physitians have ascribed too much to the Humors, under
"the notion of their being hott, dry, cold, and moyst, or
"endowed with such other elementary qualities, and have
"taken a great deal too little notice of the saline (if I may
"so speake) and sulphureous properties of things. And in
"this opinion I am not a little confirmed by the authority of
"Hippocrates himself, both in other passages, and especially
"where hee saith, *Non calidum, frigidum, humidum aut siccum*
"*esse quod magnam agendi vim habet, sed amarum et salsum*
"*et dulce et acidum et insipidum et acerbum*, etc., are the
"things which, though inoffensive to the body whilst they
"duly allay each other, prove hurtfull to it, and distemper it
"when any of them comes to sever itself from the rest and
"grow predominant."

Soe that it appeares from him that there are other agents in the body besides the humours and the first qualities, by which wee may solve the Phenomena above-mentioned, and others of the like nature, which agents and active particles, while severed and disjoyned, prove innocent and harmless, but when they fall into combinations and gett strength by their association they become authors of many Tragedies and wonderfull changes in the bodyes of man. Wee need go no further for an instance than to that common yet malignant disease of the small-pox, whose cause is connatural to us and born with us, according to the received opinion, as is owned and handsomely explicated by Dr. Willis in his book *De febribus* (cap. 15, *de Variolis et Morbillis*). His words are these: "In a woman's womb (otherwise than in most other
"living creatures) there is generated a certain Ferment,
"which being communicated to the mass of the blood, affords
"to it vigour and spirit, and then at set periods procures a
"swelling up and an excretion of the superfluous blood. But
"at the time of conception, when the menstrua wholly cease,
"very much of this ferment is bestowed on the Fœtus or
"child, and its particles being heterogeneous to all the rest,

"as a certain extraneous thing, are confused with the mass of "Blood and humours, with which being involved and sepa- "rated one from another, lurk or lie hid a long while. Yet "afterwards, at some time being moved or stirred up by some "evident cause, they ferment with the Blood, and induce to it "an ebullition, and then a coagulation, from whence many "symptoms of this disease arise."*

So then that malignant diseases may be produced this way, and perhaps here and there the plague itselfe, but that pestilence when epidemicall should have noe other cause I am not satisfied. There must bee other agents disseminated through the air which surrounds us which wee continually breath in, which must produce soe universall and spreading an effect, though Helmont seemes to speak something agreeing to what was said before in his *Tumulus Pestis* in these words: *Totum intus nostri exitium materialiter et formaliter absque externo adjutorio subinde conficitur.*† And therefore, in the third place, my opinion falls in wholly with those who make the earth the seminary and seedplott of these venomous vapours and pestiferous effluvia, which vitiate and corrupt the Aire, and consequently induce the pestilence; and that there are such vapors destructive to the principles of life included in the cavities of the earth may be evident to any one that shall but reflect upon those damps frequent in mines and colepitts, which in a moment suffocate the spirits of those that are employed about that work, and extinguish the Lampe of Life.

How many poysoned mineralls are there in the Bowells of the Earth! And I remember some Author or other who saith (I think it is Renodeus) that those men which digg in the mines seldome live above forty yeares. And Sennertus, speaking of the atheisticall life of Paracelsus, saith hee had a servant which hee kept to look after his stills, and that now and then by opening of his stills, or if it chanced not to bee close locked, that the vapours gott out a little, it put the fellow into such paroxismes and convulsion fitts that hee lay oft for dead. Besides, how many mortiferous and venomous vegetables are there growing upon the superficies of the earth, all which are nothing else but concretions or grosser consistences of those virulent Particles, which being more diffused, rarifyed, and spread abroad, fill up the vacuityes of the Aire, and render it pernitious and harmefull to the animalls that breath it in, as Poyson injected into ponds renders that element fatall to fishes, its inhabitants. And to those may

* I have borrowed this translation from the English version, "Of Feavers", published later than this MS.—Ed.

† *Tumulus Pestis*, p. 68.

bee counted as well that those venomous Animals may have their share in helping on; nay, Athanasius Kircherus doth say downe right, that these increasing in number, either dead or alive, may bee a sole cause to infect the Aire and cause a great Pestilence.

Noe man acquainted with history can bee ignorant how frequently Earthquakes have preceded, I may not say produced, remarkable Plagues. As an earthquake at Venice once did, as Mr. Howell relates in his History of Venice, which overthrew many houses, and presently after came such a sweeping plague that it almost quite unpeopled the place, and the first Plague wee reade of in the Bible (except wee count the death of the firstborne in Ægypt, a plague) immediately fell out after the opening of the earth and swallowing up Korah and the rest which dyed, 14,700 (Numbers 16). Yea, if wee may believe authors sometymes, the breaking open of a small hole or sepulchre, as it happened in the dayes of Marcus Aurelius Antoninus at Cilicia, where some Roman Soldiers breaking open a hole in the ground of a tombe gave vent to such vapours which infected not only themselves and the whole Army, but most part of the world. But Diemerbrooke counts this a mistake; soe doe I, for who can believe soe small an occasion should infect the whole Aire? But by what hath beene aforesaid, we may well resolve with Helmont that the matter of the Plague to bee nothing else but *fracidum gas terræ*, as he termes it, *i.e.*, as himselfe explaines it, *Silvester spiritus veneno tinctus*,* or a venomous vapour arising from the Earth, and as this is the opinion of severall learned Physitians, soe particularly of Dr. Willis (*De Febri Pestilent.*), who very ingeniously explaines it as hee doth all other things hee undertakes. I know the learned Isbrandus de Diemerbrooke, a person well versed both in the theory and practise of this disease, walks in a path by himselfe, and makes the cause of the Plague to be *aliquid de novo generatum*, some venome created by God immediately propagating it selfe like a ferment in Leven, through the body and masse of the Aire to the destruction of Animalls. I will now give you his owne wordes in his treatise, *De Peste* (chap. 8, libr. 1) *pestis seminarium est exiguum quid pessimâ summâque venenosâ qualitate; maxime noxium, in et ex aere ipsa Dei verbo genitum; quod instar acerrimi fermenti sese dilatans aerem hic illic certo modo corrumpere ejusque multis particulis peculiarem quandam veneni speciem hominibus aut interdum brutis animalibus speciatim infensam imprimere atque ita se longe lateque diffundere potest.* I wonder that this

* *Tumulus Pestis*, 1644 p. 68.

learned man should fly to the Creation and miraculous production of the pestilent seminaries by God without any necessity, and the occasions which hee renders as leading him to this opinion have but little weight or cogency in them. Though they lye scattered in his booke wee may sum them upp under these three heades:—first, the effects of the Plague seene to exceede the power of naturall causes; 2ndly, God in Scripture is made the Author of it; 3dly, God in the beginning created all things very good, and therefore this venome which causeth the Plague can bee noe issue and product of the first creation, but something created *de novo* since the fall for the punishment of man's Transgressions.

For answer to the first that the effects of the Plague seeme to exceede the power of naturall Causes, if wee consider the quicke and suddaine impression made by it upon the body, and the contagion of it, though I confesse these effects are unusuall and rare; yet who can say they are beyond the power of any naturall agent, or the efficacious impressions of any malignant vapour or venome, unlesse hee had made an inventory of all the poysons in Nature's Storehouse, whether animall, vegetable, or minerall, and could give us a full discovery of all their natures and wayes of operation; and this the greatest physitians and philosophers are not able to do. For *Maxima pars eorum quæ scimus est minima pars eorum quæ nescimus;* and must we ascribe every effect of the cause whereof wee are ignorant to some cause produced *de novo* and immediately from God? then for ought I see wee shall make noe end of multiplying new Creations and miraculous productions of things every day contrary to the joynt Judgment of all Divines and metaphysicall writers whatsoever, and for anything I see wee must acknowledge τὸ Θεῖον (as some would interpret that of Hippocrates), not only in the Plague, but in every Ague, Epilepsie, or any other disease, either chronic or acute, whose cause wee are not acquainted withall. Though the effects of the Plague bee and are unusuall, yet that they are not supernaturall we may find by comparing them with the known effects of severall naturall agents. Doe not many poysonous damps and evaporations of minerall substances suffocate the spirits and extinguish life in a moment? soe also doe many diseases; and for contagion doe not many other diseases cause infection as well as the Plague, as the itch, small-pox, and French-pox, rabies canina, leprosy, and many others whose cause noe man doubts to bee naturall, though they infect not in soe high a measure and degree? And according to the old rule *magis et minus non variant*

speciem, the Plague may be still the effect of some naturall poyson, though of more penetrating particles and greater efficacy then any wee know. And indeed this learned man grants the matter *ex efficiente* the plague to bee a poyson, and to diffuse it selfe, and worke as other poysons doe, though more efficatiously and vigorously. But it must be a poyson created *de novo* for the punishment of sinne—but why not *a principio*, as the materialls of many other Judgments were and layd up among other Arrowes of the Almighty in the Great Magazine of the Creation to bee drawne forthe when hee is pleased to execute his Justice upon Sinners?

And that it is soe I shall cleere up more fully in answer to his following Arguments, and soe wee come to his Second Argument—that God in Sacred Scripture is made the Author of the Plague. I answer, these Scriptures which he cites make him Author also of famine and war, as of pestilence. Now, how is God Author of warr? is hee so by creating weapons and forming Armies in the sky, and sending them downe thence upon us? Noe such matter—but only by letting loose the passions and whetting the spirits of men, of one nation against the other; the instruments hee makes use of are not Ætheriall hosts descending out of the Clouds to invade, but men of the same mould, partakers of flesh and blood. Soe in bringing famine hee threatens noe venome for corrupting the fruites of the earth, but hee either overchargeth the ground with raine and so the seed is rotten under the Clouds (Joel, i, 17), or the concurrence of some second causes intends the heate of the Aire, hinders the generation of the Clouds, or diverts them from shedding their moisture upon this or that place, bringing raine upon one city and not upon another. Or hee calls together swarms of Locusts, Caterpillers, and other known Insects to prey upon the fruites of the ground, as we reade at large in the first and 2nd Chapters of Joel. Now as God brings warr and Famine not by any new-created Agents, but by the ministry of known and second Causes, makeing them the Executioners of his Decree upon Mankind, soe wee cannot with reason suppose hee doth otherwise in the Pestilence.

And soe I descend to the third Reason that God in the beginning created all things very good, and therefore this Pestiferous venome which causeth the Plague can be noe issue and product of the first creation, but something created *de novo* since the fall for the punishment of man's transgression.

Answer.—But if venomous creatures and venoms bee not capable of this Attribute "Good"—in Moses his sense—let

this Learned man consider that hee must make the Serpent none of God's Creation; but wee find this venomous Beast in Paradise before man's apostasy and fall, and if poysonned animalls were created *ab initio*, why not poysonous vegetables and mineralls? Therefore this Learned man mistakes the meaning of this word Good, which hee might have learned from every common writer of metaphysicks. Good is a relative or respective terme, and denotes an agreablenese in anything to the nature or to the ends or intentions of some being besides it selfe. Now what was principally in God's intentions when hee reared up this Fabrique of the world but the forming of man? Man was to bee his Image and representative, and wherein doth man most resemble God but in wisdome and understanding whereby hee beares Dominion over and makes use of all the rest of the Creatures, for *τέχνῃ κρατοῦμεν ὧν φύσει νικώμεθα*, saith the old Poet. If God had not made venomous and hurtfull Creatures as well as others, man would have wanted objects whereon to exercise his reason and prudence; this quality which renders him soe like his Maker would have beene invisible and unseene, yea idle and uselesse.

Now, because I will not be too tedious about these nicetyes about what and whence the plague ariseth, but rather to passe on to those things more certaine and necessary, I will only sett downe a catalogue of these many little Peccadilloes which hitherto by most people and Physitians in the world have beene reckoned for absolute causes of the plague, which the most of them at least can bee but only furthering occasions, not originall causes, and they are such as these, viz., thickness of inhabitants; those living as many familyes in a house; living in cellars; want of fitting accomodations, as good fires, good dyett, washing, want of good conveyances of filth; standing and stinking waters; dunghills, excrements, dead bodies lying unburied and putrifying, churchyards too full crammed, unseasonable weather, south and west winds, much dry weather coming together, over watching the body, overcharging the body with nourishments, hott and moyst constitutions, overheating the body with too much venery, increase of vermin, as Frogs, Toades, Spiders, Mice, Flies, wormes, buggs, serpents, locusts, ants, butterflyes, etc. Furring and stopping up of conveyances, as Channells, Pypes, gutters, want of scouring ditches and pooles, vaults, Fens, and Marshes; hempe, flax, asphaltum, and sweet herbes, steeped long in standing waters, expiring out of putrifyed lakes and nasty Denns and Dungeons, venomous herbes, putrifying above the ground, fumes of metalls and mineralls.

Arsenick, quicksilver, orpiment or antimony (but I am much mistaken if these emit of themselves any fumes at all); feeding on rotten meate, mouldy bread; malevolent aspects and mixture of the Planets, Eclipses of the Luminaries, corruption of humors, transportation of infected goods from place to place, breaking up tombes and graves, wherein dead bodyes have beene long buryed and crowded together (yet this is not very likely to bee true, for when the Charnell house at St. Paul's was demolished there was a thousand cartloads of dead men's bones carried away to Finsbury, yet noe plague followed it). That story before-named of the Roman Soldiers exciting a Plague by opening a little hole in one single tombe must needes be ridiculous.

Many more might be gathered out of various Authors, but I think it scarce worth while, for here is more already then are likely or can bee proved to bee true, and in this they have only done as a man that would bee sure of the true Religion, therefore would bee of all. Soe because they would bee sure to hitt the nayle, they have named all the likely occasions they could think of, and all their conjectures tending to nastynes stinking and putrefaction; whereas good aires and sweet and cleanly places were noe more exempt from the disease than stinking places, and healthfull, wholesome bodyes fell under the disease as much as pocky corrupt bodyes, and more too. For my owne part farr bee it from mee to inform punctually concerning the certaine cause of a Pestilence, as noe man hath done, but I thinke I may have liberty to putt in my opinion also into the number, and I have alwaies had a conceite that seeing tyme produceth and perfiteth all things, that the Plague may be generated thus, that in some compasse of yeares or tyme the Fœces of the Earth come to a mature fermentation, which by some accident arriving towards its surface, as by dry weather and south winds, and soe the pores being something extraordinarily opened on its close body, and relaxed (as drought performes that best, for you see the dryest ground is the hollowest, and wett clay ground is close and stiffe), I say by hott or dry weather, as also by what occasion you please to think, its maligne effluvia or fume or vapour is drawne forth into the Aire, and drives hither and thither into what place the great Guider of them and all things pleaseth. And lett these punishments come when they will, though they all waies come sooner than they are welcome to us, yett to bee sure wee shall bee ready to make way for them by our sinnes and deserts, soe that as from God they are allwaies most just.

Now a word or two by way of recollection of what hath beene said, and with that I will end this portion. Most of the Authors have defined it not from its quiddity, but from the effects it workes in us, not from what it is in itselfe. Soe they make it sometimes a Feaver, and Helmont, *venenum terroris*, and Montanus saith it is the highest degree of putrefaction, and saith that a slight plague infects not unlesse a body bee extremely fitted to receive it; soe thirdly, Galen Ulsindius* defines it to bee nothing else but a changing aire into a putrefying pestilent quality; what sense there is in this let every one judge. Fernelius, who favours Astrology, concludes it to occult maligne quality in the celestiall configurations. Hippocrates and Galen come not close to the root of the matter, but only say that all Epidemicall diseases come from the Aire wee draw in our bodyes. Galen saith (lib. 1, cap. 7, *De Differ. febr.*) that the cause of pestilent feavers is inspiration, especially if the body bee fitted for such a guest, and that the greatest cause of the generation of diseases is the preparation of the body. *Corporis preparatio bonam partem actionis sibi vindicat.* Gideon Harvey and one Doctor Edwards define it to bee a malignant contagious feaver, when thousands dye of it without any feaver at all. Diemerbrooke resolves it to bee a peculiar venome in a small quantity, descending from heaven, spreading and leavening the whole aire, as a little aloes or wormewood will imbitter a great quantity of liquor. Aristotle holds it to bee infectious, and that it affects all that have a depraved habitt, *cujus contrarium est verum.* I have allwaies thought the Plague to arise from diversity of causes concurring and fermenting, and that it alwaies arose *ab infra et non de supra*, soe that I am like the Ape in the fable, accounting my own opinion most probable, which I thus describe. The Plague is the perfection of putrefaction, or if you like it better in more words, thus:—The Plague or Pestilence is a most subtle, peculiar, insinuating, venomous, deleterious Exhalation arising from the maturation of the ferment of the Fœces of the Earth extracted into the Aire by the heat of the sun, and difflated from place to place by the winds, and most tymes gradually but sometymes immediately aggressing apt bodyes.

* The Editor has been quite unable to identify this writer, or Dr. Edwards. The other authors quoted are either well-known writers, or have been already noticed in the Introduction.

CHAPTER II.

OF PROGNOSTICKS.

These are either generall or particular, either such by which we foresee a Plague coming, or such as conceive the condition of a sicke Patient, by which we predict good or evill concerning him. For the first of these, because I can say but little to it, I shall bee the more briefe. In the second I shall be the more large, as having much more experience in it. Solomon saith a wise man forseeth the evill and hideth himselfe, but in this point how many wise men had wee in our Country, or were in the world two yeares agoe? Yea, those curious observers who pretend to bee most exquisite in the foresight of future contingencies of good or evill, and a haire shall not wagge without their observation, and therefore in their yearly prediction fill the world with noyses of warrs, plagues, destruction, and overthrowes of kingdomes, monarchies, that to this said nothing at all, yet they will name the Starrs to bee in all the Fault. But as Fernelius saith, Judge only by consequences. Prophecy unto us things to come that wee may know yee are God, saith that excellent prophet Isaiah. Therefore *Deo omniscienti solummodo Gloria.* I think it may be said of the plague, as is said of the wind, that it bloweth where it listeth, and wee heare the sound thereof, but know not whence it cometh nor whether it goeth, but what things have occurred to men's weake observations I shall briefly set downe, and soe proceede.

Signes foreshewing a Plague coming are such as these, viz.:—

1. Times and Seasons, altering from their common state.
2. Many changes of weather in a short tyme.
3. Cometts, gleames of Fire, and fiery impressions in the Aire.
4. Increase of vermine, as frogs, toads, mice, flyes, ants etc.
5. Death of Cattle, as Horses, Sheepe, Hoggs, etc.
6. Famine; also warr.
7. Children in sport fancying and aping out funeralls.*
8. South and west winds blowing long while together.
9. The Small Pox or spotted Feaver growing very rife.

* Many old writers mention this curious superstition, and with evident belief. Diemerbroeck quotes several authorities, and affirms that he himself observed it in the year preceding the great plague of Nimuegen. He also observed children playing at funerals before the house of a certain friend of his, in which, a few days afterwards, three children died of the small-pox.—*De Peste*, Lib. I, cap. vi.

10. Extraordinary flowing and ebbing of springs and rivers.
11. Much cloudy weather without raine.
12. A very dry spring, such a one as wee had six months together.
13. The nights very cold, and the dayes very hott, also a cold summer.
14. Birds, with foule and wild beasts leaving their accustomed places; few swallowes were seene in the yeares 1664 and 65.
15. Women miscarrying upon every slight occasion.
16. Fruite corrupted or altered from its common tast or colour and goodness.
17. Ill conditions of the Starrs, if you will believe the Astrologers.
18. The Spotted Feaver growing rife; the Measells and other Epidemicall diseases.
19. Generally any unusuall change in the elements or creatures, whereby it seemes nature to bee out of Course.
20. Change of the waters, froggs, lice, flyes, murraine of cattle, boyles and blaines, extraordinary haile, and strange kinds of locusts preceded the Plague of Death of the first borne in Ægypt.

CHAPTER III.

DIAGNOSTICKS.

1. Shuddering Cold at first falling sicke.
2. Frequent vomitting, or at least retching to vomitt.
3. Headach, dizziness, and lightness of the head.
4. Heate and thirstiness.
5. Bleeding at the nose and sometymes at mouth, Hemroids and menses.
6. Stiffness in the Necke or Flanke.
7. Great inward heate and outward cold.
8. Carbuncles, buboes, blaines, blisters, spotts riseing on the body.
9. Distraction, staring, frenzy, idle talke.
10. Drowsinesse and sometymes continuall watching.
11. A livid Countenance inclining to blacken, also a frowning Countenance.
12. Dissolution of strength.
13. Melancholy, sighing, and sadness of spirit.
14. Griping paine in the backe, belly, shoulders, sides, hipps, bones, and joynts.
15. Oppression of the Breast, stomach, heart.

16. Much sweating and sometymes difficulty of sweating.
17. The tongue presently furred all over with white furr.
18. Palpitation and trembling of the heart.
19. Universall faintness with gnawing paine at the mouth of the Stomach and astonishment of spirits.
20. An unusuall paine in some particular part of the body.
21. A straightness in the Breast, stomach, hart, that they cannot well breath, soe as their bowells seeme to be in a presse, or the Arteries stopped.

I shall speake of noe more in this place because I am to mention many more in the next Chapter, and some of these againe.

CHAPTER IV.

EVIL SIGNES OR PRESAGERS OF THE PLAGUE.

1. Spottes appearing, either coale blacke, dark blewish blacke, purple, cleare blood-red colour, or scarlet.
2. Stopping of the stomach or oppression of it.
3. An Hiccough coming upon them.
4. Continuall vomitting which will not bee staide.
5. Their Buboes or Carbuncles falling on a suddaine.
6. A suddaine loosenesse of 2 or 3 stooles together, usually with blacke excrements.
7. Shortness and difficulty of breathing as if they were choaked.
8. Stopping of veins, and a paine about the bladder and Pubes.
9. Great inward burning heate and outward cold.
10. Faultering in the voice, stammering and speakeing in the throate, and especially lisping, with a slight pulling in one side of the mouth when they speake.
11. Continuall drowsyness and sleeping at the beginning of the disease.
12. Continuall great thirstiness, causing to drink too much.
13. Noe eruptions or very late, low, hard, flatt.
14. Sleeping with the eyes halfe open as it were dead and sett.
15. An intermitting, halting, faultering pulse, a stopping pulse, a stealing pulse, a weak, low, trembling, shivering pulse.
16. Trembling of the lipps, hands, and shakeing of the head.
17. The necke swelling much and hard either one side or round about, hindering swallowing or breathing.

18. Staggering in going about a roome.
19. Sicke faint fitts, swooning and panting, and trembling of the hart.
20. Distraction or idle talke, raving phrensy.
21. Miscarriage in a teeming woman.
22. A settled paine in the backe about the hipps which will not remove, also a pulling paine betwixt the shoulders, in the sides and belly.
23. Cold sweats about the chin, forehead, breast, hands.
24. Extreme sweating too freely and continually.
25. The belly swollen or fallen inward towards the backe on a suddaine.
26. Being taken almost blind at first with a strong headach.
27. Much belching and windyness.
28. The soares decreasing, drying up, turning blacke on a suddaine.
29. Urine shaddowing blacke after 3 or 4 dayes being sicke, also bloody coloured unless caused by applying cantharides.
30. Melancholy, sad, and frightfull dreames.
31. Restlessness, tossing up and downe the leggs and whole body from one side of the bed to another.
32. Much and deepe sighing, and hasty long expiration.
33. Contraction of the jaws.
34. A laughing Countenance with a faint forced smile.
35. A livid Countenance composed of blewish blacke, also a sharpe Countenance.
36. Being dumbe and unwilling to speake, and stupidity of spirits.
37. Hoarsness, that they could not speake out.
38. Turning, playing, and fumbling with the bedclothes.
39. Their vomitt running out of the side of the mouth.
40. Crampe in the leggs and severall parts of the body.
41. A stiffness and soarness of one side of the necke.
42. A white, soft, suddaine puft up Tumour on the necke, behind the eares, in the Armepitt or in the flanke.
43. Being overloaden with the disease, as haveing riseings, carbuncles, and many blaines on the body all at once.
44. A large extended hard tumor under the chin, and swelling downwards upon their throate, fetching a great compasse.
45. Continuing cold, shivering, aguish; and proving difficult to sweate or raise blisters.
46. Bleeding at the nose, 3, 4, 5, or 6 dayes together, after the beginning of the disease.

SOME OTHER MORE GENERALL OBSERVATIONS PROVING FATALL THIS PLAGUE.

47. Almost all that caught this Disease with feare dyed with Tokens in two or three dayes.

48. About the beginning most men gott the disease with fadling, surfetting, overheating themselves, and disorderly living.

49. Tokens appeared not much till about the middle of June, and carbuncles not till the latter end of July, but were very rife in the fall about September and October, and seized most on old people, adult, cholerick, and melancholy people, and generally on dry and leane bodyes. Children had none.

50. If very hott weather followed a shower of raine, the disease encreased much.

51. If in the heate of the disease the winds blew very sharp and cold people dyed very quickly, many lying sicke but one day.

52. Those that married in the heate of this disease (if they had not had the disease before) almost all fell into it in a weeke or a fortnight after it, both in City and in Country, of which most dyed, especially the men. The same thing Diemerbrooke observed in the plague at Nimuegen; 'tis easy to find the reason of this.

53. Those that dyed by reason of ther Buboes and Carbuncles drying up or returning inward, and those that lay long sicke before they dyed, and they that relapsed, all those dyed without Tokens.

54. Blacke men of thin and leane constitutions were heavy laden with this disease and dyed; all that I saw in two or three dayes, and most of them thicke with blacke tokens.

55. Sweating did noe good to raw boned or leane people, nor to strong men of large veines and arteries and dry bodyes.

56. The plague happening in a blood or generation, usually went through the whole kindred, though living in severall places, which was the cause it swept away so many whole familyes.

57. People of the best complexions and merry dispositions had least of the disease, and if they had it they fared best under it.

58. After one rising was broake and run, commonly another and another would rise in severall parts of the body, soe that many had the disease upon them above half a yeare. Some riseings would not breake under half a yeare, being soe deepe in the flesh.

59. Shutting up of houses, wickednesses, confident, ignorant mountebanks, overhasty cutting and burning soares, indulging too much to present ease, removeing servants and poore people to Pest-houses and to other houses in their sickenesse, overstifling and weakening people with too much sweating, overhasty going abroade into the cold, and preposterous Physick killed many.

60. Many people had the spotted feaver and the Plague both together, and many the French pox and the Plague both together upon, and yet both sorts commonly lived.

61. Teeming women fared miserably in the disease, not that they were more subject to catch the disease than others, but when they had it scarce one in forty lived, for the disease and sweating forced them to miscarry, and the miscarriage drew in the disease againe, though they had laudable soares upon them before the returne of the disease killed them. Hippocrates saith to this purpose that women with child fare ill in occult and epidemicall diseases.

62. In winter, at the begining and at the latter end of the disease, it seized people gradually and obscurely, that till 3 or 4 or 6 dayes were over it was difficult to judge whether they had the disease or noe, soe that some had the Tokens before they would be convinced they had the disease.

63. They that fell sicke with drinking Brandy and strong waters over much presently grew light headed and dyed mad; and strong well sett men (and especially drunkards) that were distracted and had staring eyes, looking about them with a wild countenance, dyed quickly, commonly in two dayes. I being sent for to two, found them both mad by drinking Brandy, and next day both dead.

64. Strength of constitution of body was noe protection against the disease nor death, for it made the hottest assault uppon strong bodyes and determined soonest, for they dyed sooner than people of weake constitution, and men dyed sooner than women, and if they had tokens they killed them sooner than they did weake persons and women.

65. All that I saw that were lett blood in the disease if they had beene sicke 2, 3, 4, or five days or more, dyed the same day.

66. Though all sorts of people dyed very thicke, both young and old, rich and poore, healthy and unhealthy, strong and weake, men and women of all constitutions, of all tempers and complexions, of all professions and places, of all religions, of all conditions good and bad, yet as farr as I could discerne the difference of the two, more of the good

dyed then of the bad, more men than women, and more of dulle complexions then of faire.

67. Although all other diseases turned into the Plague, especially acute diseases, surfetts, hot diseases, all feavers; soe for five or six months together there was hardly any other disease seene but the Plague and a few Casualties, whatever the Bills sayd, and Thucydides saith the same of the Plague at Athens.

68. Thicke cloudy weather and often changing weather made the disease hang longer than constant hott and dry weather. Raw and frosty weather contracted it apace, soe that in two weekes successively in the Fall there decreased in the Bills 3,400 and odde, and this warm winter kept it up, scattering soe long as Diemerbrooke saith it did the same in Gelderland.

69. In the summer before the Plague in 1664 there was such a multitude of flyes that they lined the insides of houses, and if any threads or stringes did hang downe in any place, it was presently thicke sett with flyes like a rope of oniones, and swarms of Ants covered the highways that you might have taken up a handfull at a tyme, both winged and creeping Ants; and such a multitude of croaking froggs in ditches that you might have heard them before you saw them. Also the same summer the Small Pox was soe rife in our Parish that betwixt the Church and the Pound in St. Giles, which is not above six score paces, about forty familyes had the Small Pox.

70. This Plague was ushered in with 7 months dry weather and westerly windes.

71. When the Plague invades people violently and roughly, at first falling sicke, such usually dye in 2 or 3 days with Tokens.

72. Plagues beginning in ye winter are alwaies the greatest, for they are spread and dilated by the hott weather following, whereas plagues beginning in summer are commonly cured by the cold winter following. Soe saith also Fernelius, Petr. Paschalis, and experience.

73. The Plague hath put itselfe forth in St. Giles's, St. Clement's, St. Paul's, Covent Garden, and St. Martin's this 3 or 4 yeares, as I have beene certainly informed by the people themselves that had it in their houses in those Parishes.

74. The Plague fell first upon the highest ground, for our Parish is the highest ground about London, and the best aire, yet was first infected. Highgate, Hampstead, and Acton also all shared in it, and Nimuegen in Gelderland.

75. High Cordialls and strong Cordiall waters, which

given to people in other diseases just as they are dying, will a little protract and lengthen their lives, some minutes at least, and sometymes some houres; in this Disease will doe noe good at all, for give them *Aq. Cœlestis Bezoardica, Mariæ Alchermes, Aurum potabile,* or what you will, and they will not live one minute longer than they would doe without them.

76. The Plague is a most acute disease, for though some dyed 8, 10, 12, or 20 dayes after they had beene sicke, yet the greatest part dyed before 5 or 6 dayes, and in the summer about halfe that were sicke dyed, but towards winter 3 parts in four lived, but none dyed suddenly as stricken with Lightning or an Apoplexy, as Authors write in severall countryes, and Diemerbrooke seems to believe it; but I saw none dye under 20 or 24 houres.

77. The evill Reliques and consequent diseases which the plague left in people's bodyes tormented many worse than the disease itselfe. What these diseases commonly are I shall speake of by a chapter of themselves. I had two patients dyed of these after-clappes, viz., one of a paine in the backe, and another of a continuall paine in the head, long tyme after the Plague had left them, and one haveing a great paine in the head had an Imposthume breake in his head and run out of his mouth and nose.

78. Many people after a violent sweate on takeing a strong cordiall, presently had the tokens come out, soe that every Nurse could say Cochinele was a fine thing to bring out the Tokens.

79. Those that dye of the Plague dye a very easy death generally; first, because it is speedy; secondly, because they dye without convulsions. They doe but of a suddaine fetch their breath a little thick and short, and are presently gone, just as you squeeze wind out of a bladder; soe that I have heard some say "How much am I bound to God who takes me away by such an easy death"; and they commonly say they are not sicke when Death is just at hand, and talke familliarly with you when they are ready to dye, and expect noe other themselves.

80. The more anyone was loaden with the Disease the sooner they dyed, and the more they infected the house, so that in some houses 10 out of 12, and 16 out of 20 dyed.

81. One friend growing melancholy for another was one maine cause of its goeing through a family, especially when they were shutt up, which bred a sad apprehension and consternation on their spirits, especially being shutt up in dark cellars.

82. Those that tooke much Brandy and strong waters for Antidotes every day dyed much of feavers, bleeding, and phrenzy.

83. Those who with Carbuncles had a great feaver or thirst if the Carbuncles did not run well nor separate themselves, nor sheale off from the rest of the flesh round about, nor rise higher, but rather sanke in lower, or grew hard and dry, or spread further in breadth; these were very evill signes.

84. Oft changing the Countenance was an ill signe, as to looke now angry, then laughing, then staring, afterwards moving, then contracting the face, then grinning, pouching the mouth and lipps without speaking.

85. All involuntary actions predicted evill, as pissing a bed not knowing it, vomitting as they lay in bed without turning the head or body, much spitting, watery eyes.

86. Prostration and dissolution of the whole strength of the body, and the patient having ill signes upon him, yet saith hee is well, being unapprehensive of his danger, was a sure signe; hee had but few sands to run.

87. Many people after they had laudable eruptions and began to move, and promised fairely, afterwards by taking many hott cordialls, strong waters, sulphurate, and Plague waters, putt themselves into a feaver and dyed.

88. Many women giving suck freed themselves of the Plague by their children sucking it from them, but some continued well some dayes, sometymes weekes, and then fell into the disease, after their children were dead.

89. A cough, sneezing and losse of limbes, which many Authors say troubled people in the Plague in other countryes, offended but little here, yet some lost their memory, haire, and senses, especially their hearing and sight, and some became meere Ideotts.

90. The winds blowing westward soe long together from before Christmas until July, about 7 months, was the cause the Plague began first at the West end of the City, as at St. Giles's and St. Martin's, Westminster. Afterwards it gradually insinuated, and crept downe Holborne and the Strand, and then into the City, and at last to the East end of the Suburbs; soe that it was half a yeare at the West end of the City before the East end and Stepney was infected, which was about the middle of July. Southwark, being the South suburb, was infected almost as soon as the West end.

91. The naturall Constitution, Disposition, and Complexion did much make or marr in the disease, and was a very certaine and great helpe in predictions.

92. The Disease spread not altogether by contagion at first, nor began at only one place, and spread further and further as an eating spreading soare doth all over the body, but fell upon severall places of the City and Suburbs like raine, even at the first at St. Giles's, St. Martin's, Chancery Lane, Southwark, Houndsditch, and some places within the City, as at Proctor's House.

93. Many Nurses by giving cold drinks to coole their feavers destroyed many, and some Nurses, as soone as they saw the Tokens, gave them a little cold water, and soe sent them to their journey's end quickly. A good feaver at the beginning helpt out with the Disease much.

94. Those that were most shy of the disease and would not take money, goods, letters, without washing or airing, or refused entertaynment of people, though it belonged to them; holding and stopping their noses and running aside upon seeing a dunghill, a doore crost or shutt up, or meeting a searcher or corpse, shutting their windowes, stopping their keyholes, and refusing company with all people, and refusing severall sorts of victualls and drinks—usually such had the disease sorest, and fared worst in it, whereas those that were more familiar in these things either had it not at all or were but slightly toucht.

95. Cheerfullness and courage of heart and spirit did chiefly uphold some in this disease, verifying Solomon's saying, viz., a merry heart doth good like a medicine, whereas melancholy and dejection of spirits was the overthrow of many.

96. Old people that had many soares upon them, especially Carbuncles, allmost all dyed.

97. Many people by Launcing, Corrosives, actuall Cauteries, Scarifications, and many intollerable applications, put their patients to more paine than the disease did.

98. Those that tooke never so good Antidotes and preservations, and followed wholesome rules, if they had a naughty heart, it betrayed and frustrated all that which was done. Many falling into the disease and dying of it, especially those that were much dejected and afrayd to dye, dyed the sooner.

99. This yeare in which the Plague hath raged soe much, noe alteration or change appeared in any element, vegetable or animall, beside the body of man, except only the season of the yeare and the windes, the spring being continuall dry for 6 or 7 monthes together, there being noe raine at all, but a litle sprinkling Showre or two about the latter end of Aprill, which caused such a pitifull crop of Hay in the spring. Only in the Autumne there was a pretty good

cropp, but all other things kept their common integrity, as all sorts of fruite, as Apples, Peares, Cherryes, Plums, Mulberryes, Raspes, Strawberryes; all roots, as Parsnipps, Carrotts, Turnips; all flowers, all medicinable Simples, etc., were as plentifull, large, faire, and wholesome; all graine as plentifull and good; all kine, Cattle, Horses, Sheepe, Swine, Doggs, wild Beasts and tame, as healthfull, strong to labour, wholesome to eate as ever they were in any yeare. Though many pedling writers have undertaken to find fault with all these things, and made people soe fearfull and carefull of what they eate or dranke, or what they bought, of keeping Doggs, of eating Mutton, Pork, Fish, Fruitts, Rootes, Salletts, especially cherryes, were much exclaimed at, and cucumbers. Yet I believe very few people eate soe much fruit continually as I did this yeare, yet was not once sicke of any disease all the yeare.

100. Many ignorant practizers (yet took upon them the name of Doctors) as soone as they came to a patient, though but newly fallen sick, would presently bee peering in their breasts or armes for tokens, thereby frighting their patients into an ill conceite of themselves. Whereas in the heate of the disease and towards the fall I never looked after any tokens at all, for I knew when they had them and when not, I knew also whether they would have any tokens before they dyed, whether they would have many or few, great or small, black or redd, how long they would live with them; yea, I seldome judged by them, but allwaies judged them by forseeing signes before they came out, for I did seldome looke after them because the Patient should not thinke I did expect their death. Yea, I most commonly gave judgment whether people would live or dye at the first visit, almost allwaies at the second, and whether they would have carbuncles, buboes, or blaines, whether they would have any feaver or noe, and many more accidents too tedious. Though at first I was baffled in giving Judgment, but afterwards by nice and long observation of the particulars I arrived to a greater skill, for I rendered myselfe very familiar with the disease, knowing that the meanes to doe any good, it must not bee nice and fearfull. Wherefore I commonly drest forty soares in a day, held their pulse sweating in the bed half a quarter of an hour together to give judgment and informe myselfe in the various tricks of it. I lett one blood, gave glisters, though but to few, held them up in their bedds to keepe them from strangling and choking half an houre together, commonly suffered their breathing in my face severall tymes when they were dying, eate and dranke with them, especially

those that had soares, sate downe by their bedd sides and upon their bedds discoursing with them an houre together if I had tyme, and stayd by them to see the manner of their death, and closed up their mouth and eyes (for they dyed with their mouth and eyes very much open and stareing); then if people had noe body to helpe them (for helpe was scarce at such a tyme and place) I helpt to lay them forth out of the bedd and afterwards into the coffin, and last of all accompanying them to the grave.

CHAPTER V.

FURTHER COMMENTS ON EVIL SIGNS IN THE PLAGUE.

I think a short Comment upon each of these observations will not be amiss, but both enlighten and satisfy.

1. *Of the Tokens*, I shall say the lesse in this place because I intend to write a whole Chapter upon them hereafter, they being soe remarkable that they deserve a volume. I have ranked them in the forefront of the evill signes, making them the forehorses of Death's Chariot, because among all the evill signs there are none so common or conspicuous, soe dispatching, certain and infallible signes of death as this. Indeed, there were many signs, many of them coming together were certain forerunners of Death, as a stoppage of Urine, faltering speech, white Buboes through a sudden looseness, shortness of Breath, stopping and oppression of Stomach, intermitting & shivering pulse, laughing, trembling, swooning, staggering, cold sweats, any more which coming two, three, or four of them together were infallible signs of Death now at hand, and they seldom came single. Yet none were soe common and constant signs as the tokens, soe none gave infallible warning at such a distance as the tokens did; for they appeared sometymes two or three days, yea sometymes a weeke before the Patient dyed, though most lived but 2, 4, 8, 16, or 20 hours with them before they dyed, but the other signs commonly appeared (most of them) but an hour or two, if soe much, before they dyed. Diemerbrook saith they lay sick with black Tokens before they dyed, but it fell not soe out here, for the black Tokens killed them the speediest of all, commonly in halfe an hour, alwaies in three or four hours; the small, purple, thick, and red ones they lived a whole day with, sometymes many dayes.

2.* *Stopping of the Stomach* and great oppression thereabout.

* *Stopping of the Stomach.*—What is meant by this affection it is hard to see. It is often returned as a cause of death, apart from Plague, in the Bills of

This was a dangerous and evill prediction sign, but this appeared a day, or two, or three, before they dyed, and it was a sign I took speciall notice of, for it helpt mee much in conjecturing upon them, and I inquired much after it, and found but few that dyed that had not much or little of it. It was very burthensome to people, oppressing their brests, hindering drink and spoon meates from going downe easily. I believe the lungs were difflated, extended, and inflamed, for they had a great thirst with a kind of suffocation and weight lying upon their brest almost like those who are troubled with Night mare. I remember but one patient that lived under any degree of it, and she lived indeed beyond expectation, for she stammered soe that you could not understand what she said, with a very great stoppage and oppression at the brest and other evill signs. I caused her to try a conclusion which came in my head, viz., I made her lay a great Mastiff Puppy Dogge upon her brest 2 or 3 houres together, and made her drink Dill, Pennyroyall, Fenill, and Aniseed water, for she was a fat woman and could beare it. Soe by degrees all her stopping and lisping left her, and she crept up again, and is very well at this day.

3. *An Hiccough;* there was not many troubled with this in the Plague, yet in those that had it it proved, as it doth commonly in all other diseases, a forerunner of present death. The posset drink I named but now for stopping is, I believe, as good a medicine for it as you can use.

4. *Continual vomiting;* this was very common in most that dyed, and if they could not stop it in two days 'twas a bad presage, for it many tymes held them till they dyed either vomiting or straining to vomit. The lungs and stomach were affected, and I believe loaden with the disease, it sticking close there, and would not come up though you gave them a vomit to boot. If soe many dyed with vomiting, as many hundreds did, what work did they make, think you, who in their printed single sheets gave directions to all people to take vomits? I shall speak of the way to stop it elsewhere.

5. *Buboes* falling of a sudden. These were the white Buboes which came more suddenly up and soft. Those which were red, and hard, and long like a wedge, and came forth more by degrees, could not fall on a suddaine, but the others in the groin, armpit, or neck being white and soft, were filled only with wind or humour, or both, and fell flat commonly just before they dyed. The first that ever I saw

Mortality, and Graunt, in his "Observations", speaks of it as a "new disease", first appearing in the Bills in 1636; but cannot explain what it was.

(to take notice of) was one of these, soe was the second, both in May, upon two women, and both upon falling dyed presently. And mee thinks there should bee a distinction made between these and the red hard risings, and not let pass both under the name Buboes, for the white ones in my mind are the true Buboes, with which few live, the other risings.

6. *Suddain Looseness;* this usually seized people 2, 3, 4, or 6 days after they were sicke. Many things are very strange and admirable to us in this disease, but hidden things belong to God; for a looseness, bleeding, sleeping, spots, and outward eruptions happening in other diseases after some days being sicke are counted good criticall signs, but in this disease they are quite contrary. They did not fall into a great looseness which held them long, only a loose stool 2 or 3 times and within few hours would presently dye, but a looseness at the beginning was not soe bad.

7. *Short, difficult thick breathing;* this is a common evill sign in almost all diseases, and especially in this, because it seldom troubles people but a little before they dye; and it commonly came on people before the tokens were out, but continued not soe long on people in this disease as it doth in others; for commonly soe soon as they begin to fetch their breath a little thick and short, away they goe.

8. *Stopping of urine on a suddain;* this was an evill sign as any, for it shewed death at hand (without it were stopt by applying too many Cantharides at once); for when they complained they could not make water and had a pain somewhere across the bottom of the belly about the Pubes, presently in halfe an hour, sometymes lesse, they expired. The reason of this is not hard to find.

9. *Inward heat and outward cold;* this happened in this disease at all tymes, at the beginning, increase, and latter end; and it boded noe good, for commonly nothing would come out upon such bodyes but tokens, and they had too much feaver; but a feaver helps.

10. *A lisping, faultering voice;* this was a very demonstrative sign after which I was very inquisitive, for sometymes I talked to them on purpose to hear how they spoke, and urged them to speak to hear them. Authors that have written of the Plague (by inquiring, it's like, of some old Nurses) how people were affected in the Plague, understanding by them that they faltered in their speech, quoted it under the general name "*balbutiens*", but what manner of defect of speech it is cannot bee understood by that word. Thus by people writing only in another tongue wee are deprived of the right

understanding and apprehension of the manner of things. This fault happened to people usually two or 3 dayes before they dyed, and by reason of this was one of the first evill signes that appeared like a beacon that gave notice afar off what would follow, and that the enemy approached. It consisted in a certain lisping or speaking on one side of the mouth, soe as their words seemed to bee cut off from the mouth before they were quite spoken out, as if they were faint and wanted breath to speak them quite out. Sometymes they spake more inwardly towards the throat. I remember but one Patient that I had, lived, that was troubled with it, which was a woman of a very strong constitution and had her courses all the tyme of her sickness.

11. *Continuall sleep and drowsyness.* About the begining of the disease, viz., about March, I wondered what people ayled. I had thought they had got lethargies, they were soe drowsy. This disposition most tymes invaded people about the beginning of their falling sick, and usually they sweat much with it also, and commonly had nothing broke out upon them, but if they had, if their sleeping continued, they dyed notwithstanding.

12. *Great Thirst continuing;* this tormented them not soe much at the beginning of the disease as some dayes after, and a day or two before they dyed. This drinking much commonly kept their vomiting afoot, and soe did them mischiefe; it also swelled their belly and lungs; now those that restrained their appetite and would not drink as much as they desired did best. Colerick people that had Carbuncles were grievously thirsty. If it continued upon people, though they had never soe good sores on them, yet it commonly killed them, and if they had a shortness and suffocation of breath and stopping at stomach with it they alwaies dyed. Those that are poysoned are commonly very thirsty, and if they drink much it swells and kills them—the lungs, liver, and stomach were chiefly affected, but most the lungs.

13. *Want of eruptions or Sores.* When these would not appear they were alwaies in danger as long as they lay sick, and if they came forth but low or flat; for it showed nature to bee but weak, distracted and hindered in her worke. Many people by purging too much, others by vomiting, sweating, or bleeding, hindered their sores from coming forth, and while nature thrust one way, they strove a contrary way, and while they thought to empty out the disease by evacuating the humors, they commonly soe weakened the body and spirits that nature would noe longer bear up against the

venome, which then would easily prevail, though never soe little a quantity remained in the body; neither had she strength enough to thrust it out into a sore, or if any dull appearance of a sore were discovered, it was but a little before they dyed.

14. *Sleeping with the eyes half open, half shutt.* This happened much to children and elder people a little before they dyed, and showed a cessation of strength and stupefaction of sense.

15. *Concerning the Pulse.* Authors pass over the pulse and urine, and say they differ not much in the Plague from their common state in tyme of health; but I believe most of them felt but few, or but nimbly and superficially, and were not inquisitive about trifling signes in the urine as they are in all other diseases. I took specially information from the pulse, and many times when noe other conspicuous signe occurred the pulse gave certain intelligence—I doe not say infallible, especially if separated from other signes. What kind of pulses I have observed I shall here set down with their effects. And *first*, an intermitting pulse, a faultring, haulting, stopping pulse, an uneven pulse, all these are but as it were the same, and little difference betwixt them. The kinds of pulses were observed many dayes before they dyed, even from the beginning of the disease, and I gave judgment by this usually at the first visit at the beginning of the disease, and presently after. I held their pulse almost a quarter of an hour together that I might give the more certain accompt of their future condition, some would faulter and stop sooner, some later, some at the 7th beate or return, others just at the two & twentieth Systole. One Patient at Westminster, a Butcher, had noe other ill signe but this for three or four days, which I alwaies took great notice of, and hee seeing mee soe diligent in feeling his pulse, told mee the Doctor sayd hee had a good pulse; but I told him it was the worst signe hee had about him and had bin soe all along, and told him it threatened him much. Wherefore he discarded mee and tooke the Doctor, but in two or three days hee dyed. I remember but one Patient in whom his pulse deceived mee, which was one, Mr. Stafford, at Acton, who, with his wife, lay sick of the Plague, having been married but a fortnight, and hee being much the worse, had a very extreme, intermitting pulse, and was brought even to the Jaws of Death, yet afterwards overcame all his weakness and arrived at the joyes of life.

There was another peculiar kind of pulse which happened in this disease. I know not readily better to express it.

It was a stealing, sliding pulse, and all I saw that had it dyed of it. This was the quality of it: after you had felt it a very little while, it would steal or slide away that you could not feel any pulse at all, unless you took away your finger and stayd a little while and then felt again, and then you should feel it again, but presently would bee gone again. This pulse was incident to children & weak people, but remained in them 3 or 4 days before they dyed. The weak, low, trembling, shivering pulse never appeared till they were weak and neer their death, and generally when the tokens were on them.

16. *Trembling hands, lips, shaking of the head;* these two first were very common, viz., the shaking of the head more rare, but were all Ambassadors of the King of Terrors. Trembling of the hands and lips is common in all other diseases, and affects people a little before they dye, and is alwaies a signe of life's Catastrophe. Soe it fell out in the Plague. But the other, viz., a shaking of the head, which was after an extraordinary hideous manner, soe that it almost affrighted the standers by; it happened to people that had relapses, and several dayes before they dyed, and chiefly to such as lay long before they dyed, and were followed with feavers.

17. *Swelling of the Neck;* this troubled people that were thick, short, and fat, and had big thick necks; sometymes the whole neck swelled round about, sometymes but one side, but alwaies very hard and much distended, soe that it quickly troubled them in swallowing, and at last in breathing; they breathe with such difficulty as if their breath were strained through some thick cloth or narrow hole. Such seldom have any tokens when they dye. It comes also upon taking cold in their sickness, and it makes them sweat much to get breath. The other diseases incident to the neck I shall speak of by and by.

18. *Staggering.* This happened commonly to strong men, for in walking about a room they would bee reeling and staggering, ready to fall; many people were thus, especially such that had a feaver, and such as would not keep their beds, and those that had a dizzinesse in their heads; but it took them many days before they dyed; some bled much at nose with it: it was a bad sign.

19. *Sick Fits, Swooning, etc.* If these continued long upon a patient it alwaies carried them away, and commonly they had noe superficiall sores, or but very obscure ones. Those that were thus troubled had but little feaver, and most tymes a bad countenance, with much sighing, shivering, and panting heart.

20. *Distraction, Raving, etc.* This happened most to strong people, and cholerick and dry bodyes; yet I have seen many children soe, and though all dyed not as were thus, yet the greatest part did; if they had other bad signs with it, as a feaver, lisping, wild countenance, low pulse, stopping at stomach through constant vomiting or the like, they alwaies dyed of it, but it held them severall dayes before they dyed.

21. *Miscarriage in a woman with child.* These poore creatures had a sad tyme of it, and it was safest for such (if they could possible) to goe out of town when a plague came upon the place where they lived. I have writ before how it comed to pass to bee soe fatall to them, yet I had two patients which miscarried in the disease and lived.

22. *A settled pain in the back and sides, etc.* These people had but little feaver but were rather cold outwardly, which was the cause they had nothing break out upon them. If they dyed in 4 or 5 dayes they had tokens, but if they lay much longer they dyed without them, and were commonly given in cleene by the searchers, for indeed they were soe, yet dyed of the Plague. Some had an extreme pain in the side, like a pleurisy, but had not soe much feaver with it, and these dyed quickly, and if you let them blood for it they dyed presently. I was with a gentleman in the morning who had this pain in the side, and in the afternoon hee sent for a barber on his own head and was let blood, when presently after I coming to see him found his pulse very bad, but noe other ill signe; but running home to bring him a cordiall, which was but a little way from my house, yet hee was dead before it came to him. With the pain in the back and hips they lay much longer, and dyed without tokens; the paine in the belly and between the shoulders killed them in one, 2, or 3 days with tokens.

23. *Cold sweat.* This appeared not till Death had taken his execution on the body and was haling away the goods, viz., the soul and spirits out of the Clay House. This signe is common to other diseases, but hath a little difference, for in the Plague it appears most about the chin, forehead, and breast, but in other diseases anywhere, and remains not soe long on the body in the Plague before they dye as in other diseases.

24. *Sweating too freely.* This also shortened many a man's journey: whatever Mr. Garencières[1] vapours, that by tossing them in blanketts three dayes together, oft sweating each day, he can cure 19 of 20, and then exclaims against the

[1] *A Mite Cast into the Treasury of the City of London* by Theophilus Garencières. London, 1665, p. 2. See Introduction.

ignorant Apothecaryes and vapouring Chymists; but I take this to bee but a bait to catch fools by the pursestrings. This sweating too freely and continual I found to bee worse than not sweating at all for many hundred tymes. Though they sweat not at all their sores would come forth kindly only by keeping them warm in their beds. Nay, I make it a great question whether, if sweating were layd aside, as many would not recover without it as with it, for if it were such a sure card as the Frenchman would have it, they had not lost three or foure thousand persons this year after they had been sweated. But it is noe new thing to hear Monsieur bragge. I practized it but little, yet I had (though I cannot say 19 of 20) yet had pretty good success, for I had 31 in 40 lived, yet most of them not sweated at all, and the most not above two hours, and that in the fall and spring, when they might better afford it, then in the hot summer: but this overmuch sweating weakened the spirits, fainted the heart, and hindered the soares from coming forth, dryed up the body, and brought out the tokens.

25. *Swelling and suddain falling of the belly.* All that I saw afflicted with this dyed; they would bee swelled a day, two or three before they dyed; but as soon as they fell, they would be taken with a shortness of breath, and presently gone, though they had sores on them. The swelling of the belly I judge was the cause either by the venome of the disease or the much vomiting or windiness and looseness. I read one author who sayeth that the whole body used to swell, but I saw not one person in such a condition, yet it is very likely such a thing may bee in some places or tymes, for many sorts of poysons will swell the whole body.

26. *Blindness and Headach.* Some are thus surprised on a suddain at first falling sick; perhaps the violent pain in the head causeth the dimness over the eyes. Such seldom live three dayes, the disease is soe acute with them; they are taken with a pulling strong pain betweene the shoulders, and presently after with a shivering cold, shaking like an Ague and vomiting. Cold windy weather usually brings this kind, and they dye speedily, viz., in 20 or 24 hours with tokens. Strong people are oft thus taken.

27. *Much Belching and windiness.* Strong people and lean were most perplext with this and at the beginning of this disease, and signifyed that the disease would bee speedy in dispatching them, for they seldom survived 4 dayes. Noe sore would rise well in them, or but windy, low, and flat ones and fell againe, and they died of the tokens.

28. *Sores decreasing or drying up, etc.* This was caused first by a feaver.

2ndly by catching cold.

3rdly by relapse.

4thly for want of skilfull and carefull dressing.

5thly by burning, cutting, and tampering too much with them and too soone.

6thly by neglecting the promoting their first rising.

7thly by preposterous applications.

8thly by drinking cold drinks.

9thly by weakness. And lastly by too much evacuations, as purging, bleeding, vomiting. Very few that had these accidents dyed of the Plague.

29. *Urine.* Indeed, generally the urine did not alter soe much as it doth commonly in other diseases of less consequence and less danger, and not soe acute. There was noe great matter as I saw to bee judged by; Only cholerick thick urines at the begining of the disease proclaimed happy success. A urine shadowing with a greenish black was generally an ill signe. They seldome had very high coloured urines, though they had some feaver, unless too many blistering plasters were applied at once, which both stopped their urine and caused them to piss blood, made them mad, and their eyes bloodshot. I shall speak more of urine hereafter.

30. *Melancholy, Frightfull Dreames.* These troubled people as bad as the night mare, for some would dream they were among Graves and Tombs in Churchyards, others that they tumbled down from some high place and fell amongst coffins, others cryed out in their dreams that they were all on fire, and these were harbingers of destruction, for they commonly proved more true then they did at other tymes in health.

31. *Restlessness.* All sorts of people from the beginning of their being sick were given to this, except they that lived, and some of them too, not only children and young people who had less reason or government of themselves, but old people were also in this fault. Their legs would never lye still, but alwaies tossing them up and down, and flinging their arms carelessly out of the bed, and many tymes their whole body was constantly tossed up and down from one side of the bed to the other with a certain raging. The former were bad signes, but this worse, for they commonly tossed about their bodyes soe till they dyed, and that they did the sooner because they moved themselves into soe many cold places in the bed; they dyed thick with Tokens commonly, because

they lay but a little while before they dyed, about 2 or 3 dayes.

32. *Sighing.* This was not from any manifest cause, as the Physicians say, but a certain involuntary action which they could not help, for children had it as well as others; they had it much about the beginning of the disease, and together with it alwaies had conjoyned a very livid deathly countenance. They most commonly dyed and in a short tyme. But I had one patient at Westminster, a maid, that promised very ill at the beginning with a very bad countenance and frequent sighing, but I bid her instead of sighing, humm it up, and ordered her friends that they should talk to her and make her as chearefull and merry as they could, and alwaies chid her for sighing, soe with two vesicatoryes and 2 or 3 cordialls she got over all and lived, which scarce one in ten did being soe afflicted.

33. *Contraction of the Jaws.* Surely the venome of the disease is very nigh kin to the venome of quicksilver, for in many of the effects there is a sympathetical correspondence. For many people being fluxed with quicksilver for the Pox have their jaws soe contracted that they can never open them again, but are forced to live upon sucking in liquid, spoonmeats, and such things. Soe it frequently comes to pass in this disease, for I have been forced to wrench open their teeth with something put betwixt to make them take things down, and as quick silver, so the plague causeth blew colour, headach, continuall deafness, cramps, pains in the back, lamenesse, spitting, swelled neck and face, alopecia, convulsions.

34. *A Laughing Countenance, a faint forced smile.* Here is the grand Traitor of all, as bad as Joab and Judas, stab whilst they kiss, or like some unlucky or subtile serjeant who while he cryes How doe you, Sir? at the next word cryes I arrest you. Or as the great Turk's Bostingi, Bassy, or Chiefe Gardner, whom hee comonly employed to strangle his great Bashawes, who, giving him a letter like a friend, claps a cord about his neck; soe in this disease, about a minute or two before they dye they will look in your face and give a smile or two when they have least reason for it, and if there were any in the room from whom they expected most help, as a Physitian, Apothecary, or Chyrurgeon, to bee sure they fixed their eyes on them, deriding in a kind of contempt their vain help and the world's deceitfullness, as the Jesuit said to his Crosses and Reliques: *Ite vana Funera!*

35. *A Livid Countenance and sharp countenance.* This livid Countenance was composed of a colour composed of pale,

black and blewish, and this seized them sometymes at the beginning of the disease, and generally with sighing and vomiting and much dejection of spirits. Middle aged, young people, and children was most conspicuous in, because the countenance alters not much in old people. This was an evill prediction, for sores rise but badly on such, and they dye most of Tokens, but the sharp countenance seldom appears before their race's end, and it is such a Tell-truth that you may believe it without a witnesse.

36. *Being Deaf and Dumb and unwilling to speak.* Anguish of mind, dejection of spirits, fear of death, make some unwilling to speak or to bee spoken to; others are soe taken up with a conceit of their past life, present state, and future condition, that they desire not to be troubled; others with making their wills, settling their estates and affairs, etc. But the reservation of speech which I mean here is a kind of stupidity of soul and spirit sometymes invading them from the begining of their sickness, and then they lye not long in the disease, but sometymes it takes them only towards the latter end; it seizeth on all people, old or young, but most on men. I saw not any hardly that lived; they dye with Tokens.

37. *Hoarseness.* Many that would have spoke out, could not, but had such an hoarseness as if they had caught a great cold, and sometyme it was caused by a soar throat which was very dangerous. Some people having had the French Pox can never speak out againe as long as they live, but only whisper, but this hoarseness tooke them but a day or two before they dyed, & they dyed most tymes with Tokens.

38. *Fumbling with the Bedclothes.* This signe is rather prophetical then predictive, and because it is common to almost all diseases it needs the less discourse about it; it shewed itself also as in other diseases just before death.

39. *Vomit pouring out of the side of the Mouth.* Commonly they had a certain stupidity of spirits and dissolution of strength who vomited thus, for they never stirred or moved their body or head when they vomited, but as they lay soe they vomited, pouring out of one side of their mouth just as you pour liquor out of a pot at one side; or after they took a cordiall, or anything very strong, presently they fell into a sweat, especially on their forehead & face, & then would vomit it up againe in this fashion, not flashing up altogether as at other tymes, but in this manner, and commonly they lived but few hours after it, dying with Tokens.

40. *Cramps.* These Cramps arose not from the same cause

as commonly they doe in other diseases, as cold, emptyness, overpurging, vomiting, bleeding, wind, sharp humors, much sneezing, drinking, or the like, but merely from the malignity of the disease. Stupefying or pursuing the vitall heat from particular parts making an unequall distribution thereof in the body, as the leggs, arms, etc. All sorts of people had it, but usually they lived but a little while who were troubled with it much, for they dyed with Tokens unless they had relapsed through catching cold.

41. *Stiff, soar neck.* This frequently fell out a day or two after they fell sick, and was an unlucky pest; they had it on one side of the neck, sometymes more inward, and sometymes outwardly, and then they complayned not soe much of present great trouble, but only of the stiffeness & continuance of it. This troubled well grown people most, and all dyed of it that I saw, but some had noe tokens, and sweating did them noe good at all, for they sweat much.

42. *White soft tumours or Buboes.* This signe was almost as bad as the Tokens. Children and old people were free from it, but from sixteen to forty odd they suffered under it. It appeared sometymes not soe soon as the red hard risings, sometymes at the first falling sick; it was more round and not soe long as the red risings, whether it were upon the neck, or behind the ear, or under the armpit, or in the flank, it was mortal everywhere, when it arose at the begining of the disease they seldom lived above three days, but sometymes it arose not till after 4 or 5 days being sicke, but when once it came it made speedy work, commonly it fell flattish just before they dyed, for it was filled with little but wind. They had but little feaver with it, but vomiting, and sometymes without vomiting, with a livid or squalid countenance & faintness; they dyed oft without tokens and very suddainly. I judge these to bee the right Buboes; the first two plague risings that ever I saw were of this nature, upon two very strong lusty men, and both dyed suddainly upon their falling without Tokens.

43. *Being overloaden with the disease.* Pure Melancholy bodyes, and the compound constitutions of Choller and Melancholy which most tymes gives a black complexion and a thin body; such bodyes as these were most peppered with the disease, and next these, old people were heavy loaden also with the disease. I could tell you many horrible stories concerning this very thing, but that it would take up too much room and tyme, and I rather affect brevity then bulk. Now though many young people and children had a great many soars of different sorts, yet they were not great car-

buncles, nor soe venomous as in old, and other complexioned people. Children would have 8, 10, or 12 blains at a tyme together with a rising or two and yet doe well, but the other had some tymes many blains at a tyme together with a carbuncle or two, a rising, and after that as full of the Tokens as any besides. In some they appeared not much outwardly in soars, but dying quickly shewed the body to bee overcharged with the disease by a multitude of black Tokens coming forth.

44. *Great swelling under the Chyn.* In some the disease happened to settle here very hard, & fetching a large compass soe that it hung down ike a bag upon their brest, which sometymes hindred their speaking & swallowing and choakt them, and it seldome broke kindly, they had but little feaver. Middle-aged people were afflicted with it most, and some old people, they all dyed without tokens, they lay sicke pretty long before they dyed, some it tormented soe much that they were mad with it. One woman being thus, falling downe stairs broke her imposthume & neck together; but few lived.

45. *Continuall Cold, aguish, difficult to sweat and raise blisters.* Children and young people were most of this condition, they would not bee ruled, they would not take things nor lye still, which was one cause they dyed almost all in 3 or 4 dayes with a few tokens.

46. *Bleeding at the nose, etc.* Those that bled pretty freely at the begining of the disease escaped best, but continued pitifull weak a great while; and some women having their courses from the disease's beginning did well, but that little short bleeding which usually they fell into 2, 3, 4, 6 days after their falling sicke was most tymes but the lacquey of death; for though some lived, yet many more dyed, and it was a vain thing to hope or look for a Crisis in this disease, for that brings death with it. And this little short bleeding was just of the same nature with the suddain little looseness of one or two loose stooles 3 or 4 dayes after their falling sicke, which is a certain token of death approaching, for thus the case falls out betwixt this and other diseases. Other diseases will bee better turned out through the common channels of nature, which she hath ordained for the evacuating and easing herself of all burdensome and unwelcome Guests, either of humors or excrements; I mean diseases of plenitude, and therefore a looseness, or sweate, or bleeding, running nose or ears, ofttimes carries off the disease, but this disease differing from all others will not bee soe easily unhoused, nor the same way. For the occasion of this bleed-

ing and looseness I reckon to bee only this: Nature having endeavored a day, two, or three, to congregate the venome and thrust it out to the superficies of the body, and being hindred in her work by some intervening accident as preposterous physick, outward cold, or too much restriction of the pores, or want of humor to carry it off withall, and too substantial gross, thick, compacted, hard, solid flesh, as it happens in lean bodyes which have too much scarcity of humour to pass the disease out upon, or raise a kindly soar. Or else nature is too weak to oppugne the disease and give it a writ of ejection, and then upon the retreat of the venome it forces a slight evacuation either of blood or excrements by virtue of its malignity, soe that these eruptions or evacuations are nothing else but the effect or return of the disease towards the interior region of the body, and therefore must bee needs very evill signes, especially the loosenesse. And by this you may see the reason why the pissing of blood was soe fatal a signe as Diemerbrook observed it to bee at Nimuegen, though this pissing of blood was not found here at all that I saw or heard of. Thus I have expounded the whole riddle of this disease as to this which is a main point and unfolds a method to the true way of cure, which justifyes that good old saying of Hypocrates, that what is to bee evacuated must bee driven that way which Nature is most ready and prone to lead to and point out.

The other more general observations need noe explanation, being written something more at length, and I affect not tediousness, especially in matters historicall.

I shall set downe a brief Compendium of good signes, and soe proceed to describe the particular eruptions.

CHAPTER VI.

GOOD SIGNES IN THE PLAGUE.

1. Those who had a moderate feaver, and were not overthirsty, neither vomited nor strained to vomit over much nor over long, and had noe looseness; such promised fair and most tymes did well, for the feaver helpt much to thrust out the disease, but many going about to cure the feaver spoyled all.

2. Those in whom the disease first lighted on the superficies of their body, without being sick, and soe continued, whatever kind the sore was of, and whether it broke or noe, they all did well.

3. When the Plague invaded the body remissly and kindly at first, most times they lived.

4. If their vomiting staid in due time, and had but a slight headache, and thirstiness not violent, noe belching, or any strong settled pain in any particular part, but had red pimples, blaines, hard red risings or carbuncles thrusting themselves forward pretty early, such fared well.

5. Bodyes with narrow veines, much flesh, and humors, commonly fared better under the disease than the contrary.

6. Those that layed the greatest restraint upon themselves, forbearing drinking, tossing, & passions, fared best.

7. Women of good constitutions and complexions having many of their courses in the tyme of their sickness usually did well.

8. Many being of a suddain taken with a violent vomiting, and continually soe, not above 2, 4, 6, or 8 hours, and then staying of it self, such were well again presently, and the disease proceeded noe further, like a suddain storme soon over.

9. They who accustomed their bodyes to take good Antidotes, seasonably and constantly, and were not over fearfull, either had not the disease at all, or if they had it, it fell upon the superficies or outside of their bodyes, soe that they seldom dyed or were sick with it, unless they caught it with some suddain fright or were extraordinarily timorous, for then nothing prevailed either to protect or cure them.

10. Old people that had the disease oft times were not sick at all, such commonly lived, unless they were too much loaded with it, or unless they caught it with some suddaine fright, but if they were sick with it they seldom lived.

11. When the sores came forth pretty early, and hard, and in good places, they most times lived.

12. Blackish and blew blains that had a pretty full bladder strouting like a cherry almost ripe, though they had most feaver with these, yet commonly they fared better with them then with the whitish yellow, flat, paltry blaines like the small pox, though authors say the contrary. I saw one man at our pest-house with a blain upon his leg almost as big as a stoole ball,* as blew as a razor, and as full of matter as the skin would hold, and a great feaver with it; I bid the nurse open it with a penknife, and gave her a playster to lay to it afterwards.

13. Thick black urine at the beginning of the disease was a good signe, a physician seeing the urine of one of my

* Stoole ball = cricket ball; but whether as large as a modern cricket ball may be uncertain.

patients, which was as black as ink, said hee would dye in 6 hours. I laughed at him, and sayd hee would live, yet the people, for fear of being shut up, removed him to another house in the middle of his sickness, which had been enough to have killed him alone; notwithstanding hee did well, and soe continues to this day at Temple bar.

CHAPTER VII.

OF TOKENS, CARBUNCLES, BUBOES, & BLAINS.

Of these I shall speak distinctly, and in all of them shall demonstrate at large these things:

1. Their Matter or essence, their Cause and names.
2. Their Bigness.
3. Their Figure.
4. Their Number.
5. Their Place.
6. Their Tyme of appearing.
7. Their Colour.
8. Their Substance.
9. Their Subjects.
10. Their Temper & Difference.
11. Their Accidents.
12. Their Effects.

CHAPTER VIII.

OF TOKENS.

Because there is noe proper name in Latin for these spots to distinguish them from marks or spots of other kinds, Authors have called them *exanthemata*. They might have called them by some Compound name to have made them better understood (seeing they could not express them by one single word), as *Maculæ venenatæ, pestilentiales, lethales, mortiferæ*. Other Authors have been very silent about these; they quarrelled not about them, nor fill the world with cart loads of books about them, as they have done of feavers of severall sorts and other nicetyes of lesse concernement. Wee have named them Tokens, and very fitly too. The scripture called the manifestation of God's Mind Tokens, "the Heathen are afraid of thy tokens", and these are in many respects soe called.

1. They are Tokens of Death approaching.

2ly. They are Tokens of God's wrath for sin, for here God punisheth according to the kind as hee doth often; you may read examples enough both in scripture and history, where many tymes in the punishment are pointed out both kind, tyme, place, & degree. And thus man having made his soul like a leopard's skin by the guilt of multitude of sins, God to convict him of them makes his outward skin in the like case spotted.

3ly. They are also tokens of God's mercy, for by these hee forwarns men as by a beacon set up to discover the approach of the enemy Death; and that hee is now steering out of the river into the ocean, out of this narrow compass of tyme into the wide ocean of eternity, soe that they may have some hours to set their thoughts in order (as hee bid Hezekiah by his house) to prepare themselves to meet their God.

4thly. They may bee called signs or tokens because they are certain significations of the nature of the disease, of the truth of it, that it is the Plague, and the state and condition of the Patient, *sed non hærere in cortice*; that it does not stick in the Bark.

Diemerbrook hath spoke most of any of them, though not to much purpose; but I digress too much. The Tokens are a small round mark or spot fixed in the outward Corium or skin; they are generally orbicular or round, but sometymes long, but that is rare; and as I suppose caused by many coming out together in a long trace; they are generally but as big as spangles or silver half-pence, but some as big as a silver penny, and then they are counted very large. I hear some talked they were as big as groats, I have seen some such red marks, but they were not the Tokens, and I believe they were all deceived, not knowing them. They are generally of a compound colour, yet some of a simple colour, as pure black, but most of them of a purple colour, which is com pounded of red and a little shadow of black in it. Some authors write of green Tokens, which I never saw, nor I believe themselves neither. Some are of a blackish blew, upon their thighs oft, they seldom are of a violet colour, or bright sky-blew till they are dead; there is another sort of little thick ones of a brownish colour, and there is another sort which are commonly but little, but red-like drops of fresh blood fixed in the skin, they bee of a bright scarlet red. These last are most found in sanguine and flegmatick, and generally on very clean skinned people; the black ones come on black and melancholy people, and the purple ones generally on any body. The thicker and smaller they come

out the longer they live, commonly a week in this manner if the black ones come out thick and large they kill presently, often in half an houre, but many people dye just upon their coming out, especially when they have but 3, or 4, or 6, or but few. Sometymes more come out when people are quite dead.

Many people dye within 2, 3, 4, or 6 dayes of the plague and yet have noe tokens, nor yet have noe risings or soares, yet dye of the Plague. They seldome dye of the Tokens if they live above 8 or 10 dayes after they are sick. When Tokens come out upon them before they have cold sweats and shivering fits and pulse, they have but few and scattering; they come out first upon the inside of the arm, I seldome saw any on the back, as the Doctors say, neither doe I think they take the pains to turn them upon their backs. Commonly the necke and breast is full of them, the belly hath but few, but the legs and thighs have some, but not soe many as the arms. People that were old seldom had any; all other ages were subject to them. People began to grow very sick and faint at stomach after they had them, and were very sad and dejected in spirit when they saw them; they that dyed distracted seldom had any. They were not frequently seen till summer, for I have heard of such things very narrowly looked after, but never saw none till June; they are but meer colour and shadow, and nothing of gross substance as Diemerbrook writes, viz., That they rise up from within, deep, ascending narrower and narrower to the top of the body or superficies of it; and that they are voyd of sense is only a tale. To prove this I have felt with my finger upon great Tokens to try if I could feel anything substantial in them, but could perceive nothing by feeling but the very skin, and they could feel easily when you pinched or pricked them, for they must bee mortifyed or extraordinarily stupified if they were voyd of sense, as a Carbuncle is when it is ripe. But these are but little light effluvia or vapours of the infected body and spirits scattered over the whole mass of blood and spirits, for the whole mass of humors & spirits are infected (though perhaps the Gall is not). Soe these exhalations being carried in the vital blood and spirits through the veins and arteries are diffused through their mouths into the skin by reason of whose density there they stick and appear. Sometymes they will come and be gone and come again, they have but little feaver when they have them; the more feaver they have, the less apt are they to have them.

I mistook spotted feaver—purple spotts—for tokens at

first, and indeed they differ soe little that none but those that are used to both sorts can know them. I will give you some rules to know them by.

First. The signs that usually appear in the Plague are absent most of them (especially the worst of them) in the spotted feaver.

2ly. These spots come out more thick and small than tokens, but many tymes you shall see one among the thickest much bigger than ye others.

3ly. These commonly come out first about the neck very thick, and afterwards all over the arms and brest like flea-bites.

4ly. They are never of any other colour but purple, or red, browne, and very small. This disease is very rife in a Plague tyme. A whole Alley in Westminster had it in every house and most lived.

5ly. They have more feaver with these than in the Plague, but dye not soe much as of the Plague.

CHAPTER IX.

OF CARBUNCLES.

Carbuncles, Tokens, Buboes, Blains are originally primarily and radically the same, having but one efficient cause, viz., the Pestilent venome, but as it meets with different subjects and accidents it spreads itself into different effects as various sores and Tokens. But concerning Carbuncles, they are soe called either from Carbo or Coale because it is hot, dry, scurfy, & burnt like a coale, or flesh burnt with a hott Iron, or else it is named soe from the stone called Carbunculus, which is of a fiery shining colour, according to the verse, *splendentes Gemmas superat Carbunculus omnes*, and I believe this might bee the boyl or blain that plagued the Egyptians and their Magicians, which could not stand before Moses because of the blains upon them. These Carbuncles break forth upon any part of the body except the Emunctoryes, where Buboes commonly break out, for Carbuncles commonly rose upon the most substantial, gross, firm flesh as the thigh, legs, back, sides, buttocks, brest, face, arms, lips, never on the head among the hair as I saw, or on the belly. As for Diemerbrook's saying that sometymes Buboes may turn into Carbuncles, I cannot argue against the *posse*, but I can say I never saw or heard of any that fell out soe. I believe cauterizing may doe it if anything will. Our Car-

buncles did come out in that manner as they say they doe beyond seas, but they doe soe confound Blains and Carbuncles together under the name of Carbuncles, that one knowes not what they mean. I believe they make noe distinction, but call them all Carbuncles, for they say their Carbuncles arose with white blisters or pimples on the top of them, very fiery, sometymes single, sometymes many together in a cluster. Our Blains rose soe, indeed as I shall note anon, but the Carbuncles rose different ways soe that one knows not how to describe them.

First a hard red swelling arose more fiery then the rising, and presently turned blackish, hard & dry, burnt, mortified, stiff, & very painfull; it commonly seized on men and women of hard, dry, firm fleshy bodyes, and much on old folks, on Cholerick and Melancholick. Children had none. They were not seen till about July, and in the autumn they were very thick. Buboes happening upon places more replete with moyst serous humor doth not soe much scorch and dry the part, nor kill or mortify as a Carbuncle doth, being bridled from both these by correcting moysture. Carbuncles differ much in bigness and fieriness, some being almost as bigg as a man's head; they are broad in compasse, sometymes raised a little higher than the other flesh, and sometymes even with a red fiery Circuit of flesh round about. Sometymes it is lower then the other flesh, and as it were sunk in a little, and spread and in breadth and grows dry; this shews the patient will dye. It sheales off round about and rots more and more when it proceedeth as it should doe, and runs much both before and after the core is out. When it is raw it sometymes spreads itself 18 or 20 Inches in compass, soe that you would think it would pull out a whole broad-side of flesh and leave the bones raw, but when it is well and healed up, but a little scar will appear and remain behind. I have had some with Carbuncles on their cheeks which I thought would have had but half a face when they were well, yet have afterwards been healed up with very little scar. A great feaver commonly accompanies Carbuncles, and Stopping of Stomach, and if these happen they commonly dye. Most commonly they have but one of these at a tyme on their body, yet sometymes 3, 4, 5, 6 on lean bodyes. They begin to appear presently after their falling sick, but are sometymes 3 weeks, a month, 5 or 6 weeks before they have done running and healed up again, but the risings are more tedious. Oft they are black in colour and hard in substance before they rot, they that dye with them lye pretty long and alwaies dye without Tokens.

CHAPTER X.

OF BUBOES OR RISINGS.

Of white Buboes and their qualities I spoke before, these I mean to speak of here are the Red hard Risings, which for the most part arise upon the neck, in the groin, under the armpit, and behind the ear, yet though Diemerbrook is of opinion they never rise anywhere else but in the fore mentioned places, and finds much fault with Zacutus Lusitanus and calls him lyar for saying that Buboes rise in other places of the body; yet surely it is not against reason that different places should produce various effects, and wee doubt Zacutus saw or heard of what hee wrote. I cannot tell how it fell out with Diemerbrook's patients. I am sure I saw many upon other places besides those in the groin, armpits, and neck (as on the shoulders and under the chyn, on the brest, on the arm), but they never would breake well, but sunk away still. They were more round then those in the groin, which are commonly long like a wedge and high like a ridge, of a red colour inclining to blew; sometymes they begin to come forth as soon as the patient falls sick, sometymes not until two or three days after, and then obscurely and deep in the flesh, which delay threatens danger, but the sooner they begin to rise the better; sometymes they are quickly maturated and break easily, sometymes they are very tedious and hard to break. I have known some a quarter of a year before they would break, some because of their hardness, and some because of their lying soe deep in the flesh, and when they are broke they are a long tyme a running—sometymes 2 months, 10 weeks, or a quarter of a year. But most of them break in a fortnight and have done running in a fortnight more. They were till July before any would break under the arm.

Those in the groin are very tedious, sometymes ten weeks before they break; but those about the neck and ears are never soe tedious; if you leave them, there will come nothing but blood out of them, unless they bee ripe and then they will break of themselves. They have not such a core coming out of them as a Carbuncle, only after they have run a good while you may squeeze out a rope of thick, long, putrified matter. Some of these risings are very big, others but small, some as big as an ordinary penny loaf, but generally about the bigness of one's fist. Generally they have but one or two of them at a tyme on them, but

sometymes 3 or 4 at once. They are very hard and painfull, and soe continue till they bee ripe, and then they are soft and look whitish at the top. Old people if they live, are seldom very sick at their coming out, but if they remain sick at stomack and doe not come out kindly they die. Moist bodies were more subject to these kind of sores then dry bodies. Children had them also in all the four places. They had not soe great a feaver with these as with the Carbuncles. They that dyed commonly had Tokens and these together; those that fell and returned again were either white ones, or else those that rose very late, low, flat, and obscurely. They made people hop and goe lame a great while. The Plague at the begining is like an Ague, and at the latter end like the *lues venerea*, for it invades them with shakeing cold, and both it and an Ague will bee cured best with antidotes and sudorificks; and the *lues venerea* hath Buboes like the Plague, and makes people hop like it. They had sometymes great inflammations round about these risings.

CHAPTER XI.

OF BLAINES.

These are sometymes called Blisters, though there bee another kind more proper to bee called Blisters then this, for it raiseth the skin in length like ones finger, but because those are but rare I pass them by. What blaines are called in any other language I know not, for I never saw a term or name simple or compound given them in any language but our own. They are a kind of little diminutive Carbuncles, but are not soe hard, black, big, fiery, or feverish as a Carbuncle, and they seize on different persons also, but they have sometymes a little core in them like a Carbuncle, only less. They are generally noe bigger than Two pence, or a groate at biggest; they are sometymes of a black blewish colour, with a bladder full of liquor on the top of them, which if you open, but a little will come out. Some are whitish, of a lemon or straw colour, they have more feaver with the other, and though they seem the worst, because they are blew or black, yet they fare many tymes better with them then they doe with the other. Sometymes they come out only first with red pimples like pustules, or pimples on people's faces, on which if you lay some drawing playster they will be drawn forth in 2 or three days into a blain. These come out sometymes just as people fall sick,

sometymes presently after, they are quickly broke and cured again; they have noe great feaver with these. They have many on their bodyes at a tyme, sometymes 10, 16, 20, they seize much on children and fair people, and tender bodyes. Perhaps it was these Job was smitten with. Noe part of the body is exempted or priviledged from them. I had one Patient had a large one upon the crown of his head among the hair on the top of his head as directly as could be aimed. They are round, and raised but little above the other flesh, sometymes not at all. Sometymes before they come out they are very sick and feaverish, they are very sore, sharp, and sometymes fiery. There dye but few with these when they once come out, they that dye with these have Tokens also, for if they dye of these blaines commonly they live not above 2 or 3 dayes.

CHAPTER XII.

OF PROPHYLACTICKS OR PRESERVATIVE MEANS.

I think by right of naturall order these ought to bee ranked before the means and method of cure, for if wee can but reach to the first there will be no need of the second; if wee can by any means keep ourselves from the disease, wee shall have little need of cure. But before I begin I shall digress a little concerning the vanity and cruelty of people's unreasonable fear in all places, Cityes, Townes, Villages, single houses. Surely it is the great mistake which they have in them about the nature of the disease, which makes them egregiously fearfull and consequently soe uncharitable, superstitious, and cruel. They have been wormed in the ears with soe many lying storyes and horrible relations, and having heard some hideous terms and frighting aphorismes; as terrible Plague, noysome pestilence, burning pestilence, and that common speech soe often used in pulpits: "Fly from sin as from a plague," and many such like expressions, which make many people believe the plague is like a Basiliske or Salamander, which kill all they see or touch. And therefore I would undeceive people as far as their vain fear will let mee, which commonly is soe great and sinful that it stops and shuts up all Counsel, Reason, Charity, Truth, etc., and makes people fall upon such vain and ridiculous courses.

I shall name some particulars: First, what care was taken about letters. Some would sift them in a sieve, some wash them first in water and then dry them at the fire, some air

them at the top of a house, or an hedge, or a pole, two or three days before they opened them. Some would lay them between two cold stones 2 or 3 days, some set them before the fire like a toast, some would not receive them but on a long pole. A Countryman delivered one thus to my wife at the shop door, because hee would not venture too near her. Concerning money, some would take none, becoming *mentis inops*, growing modest (so that one would take them for saints *pro re natâ*, nothing idolizing the God of this world); but as soon as the supposed infection is over, shew themselves partial and temporizing and returning to the old mire. Some would needs take it in water and wash it. But for clothes, they were so gravelled that they would not once come near them if they came from London, especially linnen and woollen. The same with Cats, Dogs, Hogs, etc., and generally any thing that came near or out of London; which made them keep watch and ward soe strictly, as if they would have kept the winds out of the towne, forcing some to lye and dye in Ditches, and under Hedges and Trees, and there lye unburied for a prey to Dogs and Fowls of the air. At Gloucester the Mayor of the City being an Apothecary would not suffer pipes of wine to bee brought into the City that came from London. But being brought in would have had them drawn through the river to wash off the infection; but at last it was agreed they should be excused by pouring water upon them; soe the vintner's man took a dish of water and poured on them, and sprinkled each vessel a little and soe made them wholesome, notwithstanding they had come a hundred mile in the air and it had rained on them much by the way. But seing every body can furnish you with news enough of this nature, I shall desist. Some have stopped the key-holes of their doors, and avoided the occasions of action and communication with all people & creatures, yet have not their fears been more vain then the Antidotes—foolish, superstitious, troublesome, weak, and ridiculous—which some people have used and others appointed.

I will reckon up a few of the maddest of them, and then proceed to others of more moment. Those I count of little efficacy are such as these, viz., Amulets, Tobacco, taking strong waters, brandy, etc., fumigating of houses, rubbing houses with herbs and sprinkling them, sweet powders, Troches, Odoriferous Candles, Civett Boxes, Nosegayes, Pomanders, Rope's-end tarred, spice caps, Crosses, washing the temple and mouth with vinegar. Plaisters to the groin, wrists, temples, armepitts; lozenges, haire or silk

or leathered clothes, stuffing the nose with rue, wormwood, or what else, sleeping on flock bedds or mattresses strewed with cold sweet herbs in the summer, and with hot sweet herbs in the winter; frictions, bathing, purging, sweating, bleeding, vomiting, the French Pox, issues, cordial quilts, avoiding all stinking things and places, making fires in the streets, smoaking their clothes with Brimstone and Storax, etc.; carrying venome about them, suppositoryes, Ruffi pills; washing of streets, shotting of guns, killing Dogs, and Cats, choosing high grounds or hills to live on, shutting up houses, burning infected linen or woollen, chawing Tobacco, roots, or herbs; warding towns, prohibiting goods and people intermission coming from infected places, forbearing coming into a crowd, anointing the nostrils, eating six leaves of sorrel, fasting; and it were almost endless to rekon up all the little devises and weake meanes and medicines which they have appointed and used as Shields and Bucklers. A great trade there was a while in summer of selling Arsenical Amulets, yet I judge them as effectuall as Mr. Greatrake's stroking. Theophrastus counted Pericles a crackbrained fellow for wearing an Amulet, and sure the rat killers will have a sweeping trade next year, the Arsenick and Ratbane being all spent, and the cats killed. And noe less ineffectual is the shunning and running away from searchers, warders, dead-carts, shut up houses, nurses, narrow allyes, dead bodyes, dunghills, cobwebs, Southwinds; also the sprinckling chambers with vinegar, opening North and shutting Southwest windows; keeping birds in cages or a goat about the house; flashing gunpowder, burning vinegar, or hornes, or leather, setting milk up and downe in ye house, eating garlick and butter, drinking their owne urine, continuall mastication of roots, druggs, drinking vinegar and salt, sweating once a weeke, carrying of Reliques or pictures about one, enchantment characters, pictures of stars, serpents, mysticall numbers, taking of Bezoar Epithems over the heart, unctions. As for some of these they may doe a little good, as those which concern care, and cleanlyness, and temperance. Issues for fat folkes, Tobacco-taking, Diemerbrook greatly commends, though I never took a pipe this year, nor ever doe or will doe; but how many thousand Tobacco-takers think you dyed this year, and the chief thing he commends it for (as any one may see) is because he then learned to take it himself, but dyed not of it, being yet alive, about fourscore yeares old, I believe. If it doe any good it is to those who use it moderately and never took it before, or but little. As for all those superstitions & preservatives as Amulets, Crosses,

reliques, enchantments, pictures and such like, I have nothing to say to them more then what the prophet Jonas saith, "They that believe lying vanities forsake their own mercies"; soe they that put any confidence in such helpless, frivolous trifles as these are satisfyed, and diverted from trusting in God and using better means then such empty vanities, and soe forsake their own mercies. But to hasten, I shall divide the whole business of preservation into two heads, viz., firstly, what is to bee avoided, 2ly, what is to bee done, and these may bee distinguished in spiritual, political, and medicinal; but I think to comprehend all under the two former distinctions.

CHAPTER XIII.

WHAT THINGS ARE TO BE AVOYDED.

First. All sins in general, especially such as doe more particularly and peculiarly promote judgments of this nature, which are such as these:—Lust, Pride, & whoredom, wantonness, and prophaneness; for the Plague hath been a common judgment upon these exorbitances, as may bee sufficiently proved, both from experience, reason, history, and the scriptures, to which I think may be justly reckoned these also, too much eagerness in carrying on worldly designes of profit or pleasure, as usury, extortions, buildings, feastings, publique playes, etc.

Noe less carefully ought we to avoid at such a tyme uncharitableness, both in censure and actions, contentions, impenitency, which was Pharaoh's fault, being hardened under his blows, as also Atheism, common vaine swearing, blasphemous doctrines, all open and scandalous sins together with Hypocrisy, as making great profession of Godlyness, but in the mean while following the swings of tyme and place, dishonouring God and Religion, emboldening the wicked and discouraging the good, and consequently introducing Apostacy. Indulging too much to ease, carnality and worldliness in their affections also, ingratitude for blessings and mercies, oppression, inhumanity towards poor and afflicted persons, contempt of means, mercies, ministers, obstinacy, irreverence, and relying too much to Creature help, which was Asa his fault, and generally all sinns which doe with a high hand provoke God's wrath.

And then, in the second place, you are to avoid all things and occasions which may but in the least agree, prompt, and further your liableness to receive the disease, as too much

drinking wine, strong Beer, Brandy, strong waters, or whatsoever other gormandizing, fasting, thirstiness, all odoriferous things unless some present stinking occasion require them; All sorts of venemous amulets, reliques, enchantments, and such like fopperies. Bathing, purging, bleeding, vomiting, swimming in ponds or rivers, all overheating or tiring the body, all suddain changes in the Actions or Passions, much and hasty inspiration, firing the aire in hott weather, killing dogs and cats, because it is needless for they never have nor carry the disease, whatever authors say or think, but when they are dead they lye stinking and doe mischief. High grounds, or hills, especially bleak windy places to live in. At Hampstead died two hundred, three score, and odd, out of about a hundred houses, yet at the West End a little village soe called a quarter of a mile off, at the bottom of the Hill, there dyed none, though there are about thirty or forty houses there; contrary to the doctrine of many authors, who have said that scearce any who live upon hills in cleere aire ever have the Plague. Acton, Highgate, Islington, also had as great a dose of the disease as others.

OTHER THINGS TO BE AVOIDED.

Shutting up of houses when once it is hot weather, and the disease is grown thick (for it hath been oft enough tried and alwaies found ineffectual); entering into needless crowds and dangerous places, specially tarrying over long on such occasions; over timorous and suddain amazement and running away from infected persons and places and things. But especially avoid the wearing and use of all linen that hath been used about the body or bed of sick patients, for that is worse than woollen, and the smell of sick people's excrements is enough to strike one dead in an instant. Impure and foggy aires, South and South West windes, all putrifying things, rotten rootes, herbs, meate, waters, liquors, bread; nastynesse, cobbwebs and generally anything whereby the infectious aire may hold open or bee detayned. Too great fires in the summer and too little in the winter, lying neere Churchyards or other burying places too full crammed with dead bodyes of the Plague. Too great fullness, and too much emptiness of nourishment or humors. All suddaine changes either of Actions or Passions, places, drinkes, dyett etc. Among Fleshmeat, to avoid much feeding on Pork, and too much Fleshmeat, especially such as this because of its moisture and tendernesse is apt to corrupt and putrify by reason of too suddain a digesting; too early and too late

walking abroad in the air before the clime have discussed the Fogs and Mists and evil vapours.

Many sorts of Fish are thought also to bee destructive, as Herrings, Salmon, Eels, Polypus, Soles, Stockfish, Haberdine, Whiting, Muscles, Cockles, and many such like. Also many sorts of fruits, and generally all fruits over ripe, over sweet, luscious, fulsome and laxative, as many sorts of Plumbs, too soft, moyst and sweete, and many kinds of Pears of the same nature, and some few Apples and over ripe Cherries either blacke or red, but especially some sorts of gardners' fruit, as Cucumbers, Mellons, Pompions, Leekes, Onions, and Garlick. Also (whatever Galen saith to the contrary) Jerusalem Artichoakes, Parsnips, Lettuce, Spinage, Coleworts, Gourds, Dates, Figs, Intybes, Poppies, Prunes, Gooseberryes too ripe, Sebestens, Beetes. Liquorish, as the Spanish Doctors think is not good, nor Sugar and Hony. Some condemn Asparagus, Mallowes, Mercury, Henbane, Sowthistle, Opium, Manna, Oyle, Muske, Pigeons, Quicksilver, Lead, also drinking water or beere too new, too small, new and sweet wines, new ale. As for Exercise—avoid overtiring, sweating and overheating the body, overmuch or too little sleeping, too much venereall exercise, especially people unaccustomed to it. Therefore marrying in a Plague tyme is very dangerous, especially for men, as the great number of widdowes everywhere testifyed. Also sleeping in the daytyme, sleeping in the sunne or upon hay, also all unquietness and disturbance of the Mind and Spirits, as well as of the body; as Anger, Fear, Grief, Sadness, especially suddain Fear or Joy, also too much care, study, distrust, fearfullness, discontent.

CHAPTER XIV.

WHAT IS TO BEE DONE? FIRST, OF FLIGHT.

Beza and some other Divines treating of this point and commending and advising it, doe not like well to have it called flying away, perhaps thinking it a scandalous term, but would have it called only going aside, a more moderate word. All physitians terme it Flight and many of them scruple much the advising of it, soe that some will say nothing at all to it, neither persuade nor dissuade, but leave every man to his choice, but the Divines have beene more bold, and advise it more eagerly and condemn those that betake not themselves to their heels. Nay, they say people are wicked and provoke

God in not doing of it. The Turks (they say) neither fear nor fly from it. As to the lawfullness of the thing I see noe reason why people should soe scruple about it, seeing an indifferent understanding may solve the doubt; for sure it is lawful if a man live not in a healthful aire to remove into another, or if a man doe not sit easy, to remove to another seat; a man hath the world before him and given him to live in. The heaven is the Lord's, but the Earth hee hath given to the children of men, as the prophet sayeth, neither is it only lawful, but convenient also, for by this means many lives are saved, soe that the land is not soe much weakened by the thinness of people, and those that are gone can better provide for those that stay, by sending them reliefe of money and victualls, also it much abates the fury of the disease, for by making the inhabitants thinner, it rages not soe much, for more fuel, more fire and woe. It is lawfull to fly from other epidemical judgment, as Famine, War, persecutions, etc. And then why not from the Plague also. But, saith Diemerbrook, you must fly in the Fear of God, and indeed that was well put in, for if wee feared God more, wee should feare all evil less, and the plague less, and soe the less prone to catch it, and the fear of God is as universal a remedy as flying away. Solomon saith it is the Fountain of life for the avoiding of Death, but those that make use of this preservative would doe well to join prayers and alms, which would sanctify it to themselves, and help their neighbours.

But here ariseth another question, who may fly, and who may not, for it is not to bee thought that all may run without distinction, care or consideration; but as for children, I think it would bee well if they could bee all put out into the country, for what good doe they in a dangerous place, but make work and trouble, and add fuel to the fire, they being more apt to catch the disease than others? And as for others, I think all may fly that are free and not obliged to stay either by their office, relations or necessities, such as Magistrates, Ministers, and Physitians, Apothecaries, Surgeons, Midwives. But those Apothecaries which have their work and dependence from the Physitians are not, I think, obliged to stay behind, when their Masters lead the way; for who shall direct them? They say it is not our business to direct or undertake to give Phisick of our own heads; therefore they are to bee excused. But those Apothecaries which stand upon their own Legs, and live by their own practize, are bound by their undertakings to stay and help as in other diseases. Every man that undertakes to bee of a profession or takes upon him any office

must take all parts of it, the good and the evill, the pleasure and the pain, the profit and the inconvenience altogether, and not pick and chuse; for ministers must preach, Captains must fight, Physitians attend upon the sick, etc. But two or three of the yongest are appointed in a plague tyme to looke to 30 or 40 thousand sick people, when four or five hundred is too few, and at another tyme, when there dyes but two or three hundred a week, you should have 5 or 6 hundred hanging after them if they bee well lined with white Mettall. 'Tis the Rich whose persons are guarded with Angels.* These are the carcasses whose stomachs shall bee cloyed with as much phisick for the cure of the Toothache, as the cost would cure half the diseases of the Town if honestly ordered. But if four or five Physitians bee enough in such a plague as this was, surely one is enough for common diseases at other tymes. But to speak a little more of flight, I think those who are very fearfull ought especially to fly, and that quickly, but for parts of families to fly is altogether to bee condemned;—for a man to fly, and leave his wife, children, and servants, or the wife to doe the like, or the Master and Mistress and children to fly and leave the servants or any part. Either let all stay or all go, or else but only children, and bee sure to observe the old rule, *longe, cito, tarde;*† for many in our Parish and many more in the City intending to fly lingered soe long that they were taken with the Disease and dyed before they could get out. Others went too little a way off, as 3, 4, or 5 miles at most, and there were taken sick, for unless people go 10, 16, or 20 miles off at least, they had as good stay at home, for all the aire was infected round about the City for 7 miles round, soe that the further you went, the safer you were. Then againe some returned in the heat of the Disease, as Mr. Bolt, the Apothecary, and a Grocer by us and many others by us, and dyed. Such had better a great deal never have stirred out of the City, and others who returned about October, November and thereabouts came too soone for their safety; but necessity must pardon many such errors. Teeming women should forsake infected places because of the great danger. The best way to fly is thought to bee Northward not Southward. This shall serve for those

* The point of this little joke will be missed if we do not remember that a physician's fee at this time was an *angel;* a gold coin then worth ten shillings. To the same effect was a gibe of Nicholas Culpepper's—that physicians of the present day are like Balaam's ass; they will not speak till they see an *Angel.*

† "Hæc tria pestiferam pellunt adverbia tabem,
Mox, Longe et Tarde, Cede, Recede, Redi."
That is:—"Flee quick, Go far, and slow Return."
(An old couplet quoted by Gideon Harvey.)

that are able to save themselves by flight; those that are necessitated to stay behind and abide the shock of Battle, deserve to have more pains taken in prescribing them rules and means of safety, because they are in the greatest danger.

CHAPTER XV.

PRESERVATIVES AND MEANS FOR THOSE WHO STAY BEHIND.

After Humiliation, Confession, and resolution for reformation of life, which is necessary at all tymes, especially at such a tyme, because of the extraordinary fickieness of our lives, wee may the more comfortably and confidently descend to the use of other means of inferior ranke; and in these I will not make many nice divisions, for the avoiding of tediousness, because it overchargeth people's thoughts and memory; but after a few short rules concerning aire, meate, and drinke, fullness and emptyness, exercise and rest, sleeping and waking, and passions of the mind, I shall descend to medicine. Therefore first, concerning aire, little can bee done concerning this because all that wee can do will work but little alteration in it, the effect of all that bee done, being soe flitting and transitory. Yet a great bustle hath beene made among Authors and the people, about correcting the aire (as well as correcting of medicines which comes to as little also). I have not spent two farthings this yeare about correcting the aire in my house, yet I think I had as wholesome aire blowing in my house as my neighbours, many of which filled their houses every day with smoke to fumigate and correct the aire, yet I had noe body sick or dyed in my house all this year, nor in my life; for my man was taken sick in Gray's Inn Fields, and lay sick but a day, and then dyed with Tokens in another place. But because some people have great conceits about correcting the aire, I will set down all the devises I can think of which may do any good. As in winter tyme and in foggy and moyst places and tymes, especially nights and mornings, to keepe good fires if you bee able (though it bee in the summer, nights and mornings will doe good). Wood fires are accounted best, and if you bee more choice about the quality of your wood, you may choose Juniper wood, Ash Tree, Oak, Guaicum, Lignum, Aloes, Asphaltum, Sassaphras, Cypress, Rhodium, Maple, Beech, Walnut tree, especially Orange tree, Barberry tree, Service tree, Box and Bay Tree, any Arromatick tree, Frankincense, and Masticke tree, Myrtle tree, Apple tree, Sloe tree, or

Black thorne, Fir tree, Camphire tree, Ivy. Yet I know noe reason why Sea coale fires also should bee discontinued, seeing they commend the burning of brimstone soe much. The next, to bee sure to keep the house from anything which may occasionally infect the aire, as nastyness in generall, foul water, dust, cobwebbs, or anything rotten or mouldy, as Herbs, Rootes, Victualls; to rub houses with Angelica, Rue, Scordium, Wormewood, Southernewood, Costmary. Walnut leaves, bay leaves, Lavender, Cotton and many other are counted very wholesome, or to boyle these or the like in a kettle of water, and wash the house with it hot; to keepe the windows of the house close shut all night, and all day too in close and cloudy weather, and windy rainy weather; but on faire, dry, sunshiney weather to open the North and East windows in the day tyme, and alwaies to keep the South and West shut. And likewise to keep in the lieu [lew or lukewarm] or calme still aire out of cold bleake and windy places, but in very hot weather to avoid the use of great fires.

That was (in my mind) but a slender exploit to make fires in all the streets of London in the midst of the hott weather, and as poor success it had, and though I reverence Antiquity, and affect it as much as any man, yet I believe nothing at all of that old story of Hypocrates, his curing a great plague by setting a wood on fire. Perhaps hee might doe it upon the turning and declination of the disease, and soe perhaps it decreased apace, or perchance frosty weather clapt in upon it, and that age observed not, and thus it might goe for current in after tymes, that the Fire did the feat. As little can I think that the soldiers discharging the guns ever quelled it in any places as some Authors have written, also oft sprinckling houses, viz. the floors and the walls with Aromatick Decoctions, Waters, Vinegars, strewing Windows, Rooms and Chymnies with Sweet Herbs and Flowers, burning or fuming vinegar and rose water. Some think it fit to keep birds in cages to fan the aire with their fluttering wings to keep it from stagnation and putrefying, but I thinke this is but a trifle. Now for fuming and smoke-drying houses, this being generally practized, and for those sakes that believe in it, I will set down all simples which are good and will conveniently and handsomely burn; what woods are good I have set down already.

Burn rather Pitch, Resin, Turpentine, Asafœtida, Asadulcis, balsam of Peru, Tolu, Capivi, Camphire, Caranna, Frankincense, Tachamahacca, Storax Calamit, and Storax liquida, Opopanax and Galbanum, Labdanum, Gum elemi, Amber, Sulpher, Benjamin, Mirrhe, also some Aromatic things as

Nutmegs, Cloves, Bayberries. You may make use of any of these single or make compositions out of the woods; Gums, Spices, Roses, or any other sweet flowers being added to them. I will sett downe but one Composition, which I thinke may save a labour of writing a heap, because all books abound with variety, and one may answer to all intentions soe far as concerns fuming. Thus; take Juniper and Rhodium wood, of each half a pound. Frankincense and Rosin, of each half a pound, Storax and Benjamin, of each two ounces, Labdanum, Amber, Masticke, Tacamahacca, Cloves, Bayberries, Brimstone, Camphire, Damaske, Roses, Mirrhe, Juniper Berries, of each 2 Drams. Mingle them together and burn them a little when you please, or of the forenamed simples you may make Troches, Candles, pomanders or what you please. Besides these things oft flashing of gunpowder is much in esteem with some, and wildfire squibbs, fire balls and other, serpents, crackers and gymnacks which are commonly used on the 5th of November. Besides these, burning old Shoes, Leather and Hornes are in use with some poor folk, also the smell of a Fox or Goat is thought good by some, but that which was chiefly in vogue (and for universality of use) was smoking of Tobacco, of which I have spoken before. And thus much for correcting the aire which I think towards preservation lends but a weak hand.

CHAPTER XVI.

OF MEAT AND DRINK, FULLNESS AND FASTING.

Those errors which are commonly committed about eating, drinking, exercise and such things are very dangerous in a pestilent constitution, and the least miscarriage is apt to make a man catch the disease in a plague tyme, soe that one had need to keep his body as charily as a Venice glass in such a tyme, and though some have lived carelessly in all respects and yet escaped, yet that is nothing; for as there is noe Medicine soe infallible for any disease, nor for this, but that many people taking it some will dye, *Nil ad omnia beatum*, soe there is noe mischief soe certainly mortal (in such common lawful things) but that many people committing it go scot free; but how many clear examples might bee brought of many hundred of persons, if I might not say thousands, that have got their bane by running into but a little excess to what they doe at other tymes. But to dispatch soe much as

concernes meat and drink, may bee branched into these heads, viz. quantity, quality, tyme, custome, order, age.

First for quantity—the quantity must bee according to the substance of the Food, as it is hard or easy of digestion, nourishing much or little, and according to the strength, Age, Constitution, and Complexion of the eater, for Custome if that bee bad must bee allowed, and that by degrees, because all suddain changes are dangerous more than ordinary in such a tyme. The tyme of eating must bee minded and in that the tyme of the day and the tyme of the year; for the day, in such a tyme I think it good to eat thrice a day, though you eat the less. The tyme of the year, and soe the summer tyme requires meat colder, moyster, easier of digestion and less in quantity, the winter requires food more firm, substantial, hotter, and more in quality, the stomack then being hottest and strongest. For order it is hardly worth speaking of, for people should not bee burthened with too many particulars. And for Age a word or two will serve, viz. That children and old folks must use dyett hotter, moyster and easier of digestion, and middle Aged, strong people, the Contrary.

In drink I entend to bee as brief as may bee, and I think it a very good rule for all, and would conduce much to their good in body, Purse and business, to drink oft at Meales and little or not at all between Meales, unless thirst constrain, and for quality I judge a middle sort best, because beer too small flats the spirits too much, and too strong fires them too much. And now and then a glass of sack doth very well in such a tyme, because it takes off fear, and all melancholy etc., and cheers the spirits. As for what meat or food is to bee chosen 'tis needless to write here, because I have set down before what are naught and to bee avoided, and by avoiding them you necessarily fall upon the good. As for fullness and emptyness either of nourishments, humors, spirits or excrements, I rather commend a constant fullness than emptyness, because it more conduceth to safety, and diseases of plenitude cure better and easier than those of vacuity, but concerning Clothes, if any bee soe nice as to think any great safety lieth in the choice of Apparell (if their purse will reach it), they may wear Sattin or any kind of Silk or Hair Clothes or Leather or Oyle Cloth, I thinke these are most rationally to bee chosen. Woollen Clothes are generally condemned, yet I wore noe other all the plague tyme, nor have worn any other these seven years, but I believe the Infection catcheth sooner upon Linen and remaineth longer in it, then in woollen, and more have received the disease from infected Linen than infected Woollen.

CHAPTER XVII.

OF SLEEPING AND EXERCISE.

In Sleep is to bee considered tyme and quantity. As for day tyme, as it is at all other tymes unseasonable, being against Scripture, Custome and reason, soe at this tyme it is more then ordinary unwholesome, and as for quantity, you must have respect to Age, Constitution and Employment, but in general 5 hours is the least that can in reason bee allowed and seven or eight hours is enough in Conscience for those that work never soe hard, and in short old people, children and lean people should sleep most, and fat people, young and middle aged least, and idle, unemployed people and students should eat, drink, and sleep less than people that work hard, and the errors comitted about sleeping and exercise are more dangerous then at other tymes when there is no plague. And as for exercise, there is to bee minded only moderation, and immoderation; overheating the body is very bad, because it disturbes the humours and spirits, and makes the body more apt to receive any impression from the Aire, but it is excellent to keep one's self in moderate employment, and not to mind every idle tale they hear, which fills their heads with vain fears disturbing their apprehension and doeing mischief; soe much for this.

CHAPTER XVIII.

OF PASSIONS AND AFFECTIONS.

Little will serve to bee said concerning these, both tending to content and discontent. What dispositions are to bee avoided I have spoken of before. I believe one great cause why this disease sweeps away whole families is because they grow Melancholy and discontented, one friend for another, especially being shut up brings a sad cloud upon their spirits. Now when any one perceives himself very fearfull and Melancholy and cannot well rid himself of such a humor, he must use the means to overcome and alleviate it, the most common and effectual are three, viz., Company, Wine and Musick and any other lawfull diversions; and in short I could commend Stoickal life, temper of spirit, viz., to observe and carry an even brow under all change of good and evil, not to bee dejected at ill newes nor suddenly raised at good, but to fix in an immoveable resolution. As for sack, 'tis an excellent

Antidote for Melancholy people if they keep a due moderation as a pint in a day, because it takes off care, sadness, etc. As for musick, some may think it very unreasonable at such a tyme, which requires a contrary temper of spirit, and consequently unlawful, but I think noe man need bee soe nice and narrow spirited, as to question the lawfullness of private solace and Chamber Musick, especially when it is used for such a good purpose, and sure noe man thinks that I mean your wild wanton, hackney fiddlers, whose employment is altogether to bee condemned at such a tyme.

CHAPTER XIX.

OF MEDICINAL PRESERVATIVES.

These are either outward or inward means or occasions; means as amulets, plaisters, nosegayes, sweet boxes, issues, bleedings; or occasions which commonly are some kinds of diseases which accidently become preservative from the greater disease, as sometimes many petty infirmities keep off greater fits of sickness, and hence perhaps came that proverb of a grunting wife, etc. Such diseases as these are commonly as good as preservatives, but I would not have anybody to trust to them. Old outward sores or ulcers, cancers, polypus, ozena, boiles, Kings evil, itch, French Pox, scab, scaldheads, Leprosy, fistulas and running sores; and that such things as these should fence people against the plague is not against reason nor experience, for though like draw his like, yet are there venomes of different nature which are Antipathetical and expell one another. That this is not against experience witness all the common prostitutes of Lukener's Lane and Dog Yard and other places, where all these unclean beasts are still alive, and scarce one dead, yet are almost all of them full of old sores, itch, scabs, running sores, pox, fistules, ulcers, and such like, soe that those that make use of them had need of stomacks like Ostriches able to digest a tennpenny nail, whom you may trust in a garrison. Soe much for the occasions, as for the means, I have spoke of all of them before except Issues.

As for bleeding, either for cure or preservation, it is wholly to bee layd aside, for if you use it to cure, it presently kills, if you use it for preservation you catch the disease the sooner and the easier, and twenty to one but you dye of it to boot. Now for Issues, I like well of them for fat people, if they run well, but for lean old people

and dry bodyes, I think them bad, but I would not have anybody trust to them alone, and use noe other preservative. Now to Medicines, all Evacuative Medicine is to bee avoided, except only a few gentle ones which may serve for melancholy and dry bodyes, that are commonly bound three or 4 days together, and such may take once a week of Ruffi pills, and which I think is as good or better, Pilulæ Aloephanginæ; such a dose also, or such an extract as this ℞. rad. angelicæ, imperatoriæ, enulæ, gentiani, Zedoarie, baccar. Juniperi, rad. serpentariæ, vel gentianæ ana ℥ s.s. fol. scordii, cardui, rutæ, ana M. i. Cinnamoni, charyophyllorum, croci, dictamni cret. ana ℥ ii Cort. extern. Citri, summitat. Centaur. ana ℥i folior. sennæ, agarici ana ℥i s.s. rhabarbari ℥ i epithymi ℥ s.s. infundent omnia contusa in vini albi q.s. per septimanam deinde coquentur leviter et colaturæ claræ adde aloes optim. ℥vi Myrrhæ claræ rub ℥i s.s. balsami peruv., Mastickes, ol. nuc. Mosch. per express. ana ℥ ii M. et evaporando redigatur in Massam idoneam. Of this pill may bee taken two scruples once in 4 or 5 dayes, but as for myself, I never took a grain of any pill or any purging physick these many years, though I count not this for a rule for everybody; but some cannot swallow pills, yet can take potions well enough though bitter. For such may bee made such a wine or Tincture as this: ℞. Rad. enulæ, petasitis, angelicæ, contra yervæ, bardanæ ana ℥i, fol. scabiosæ, abrotoni, pimpinellæ, scordii ana Mi flor. calendulæ ℥ s.s. cinnamoni, nucis moschatæ, Charyophyllorum, Zedoariæ, Centaurii ana ℥ ii aloes luridæ ℥ii rhabarbari ℥i incisa et contusa singula infundentur vino albo (vel pro pauperibus in Cerevisia bona) lb xii vel xvi et bibat quotidie mane ℥ii vel iii. These are enough seeing every book is loaden with Receipts though not one in forty worth anything in many of them, for everybody will bee overtaking to write Receipts though they durst never look the disease in the face. Now something should be contrived for poor people seeing they cannot fly because they want money; therefore the disease lyes hard upon them. The Germans in a plague tyme invented this powder for the poor, viz. Ginger and sugar of each an ounce, camphire half an ounce mixt together. This I like well enough, and it would bee very suitable for poor people, but that the Camphire is dear, but if the Camphire were as cheap as the Ginger, how should the poor have soe much of it as would serve such a number—soe many hundred thousand people—unless the rich would joyne together to lay in a stock to procure it for them, which is seldom put in execution.

Therefore something should bee devised for them which

lyeth within the reach of possibility to bee had for them, and I can think noe easier or better way at present (if any knew a better, they would doe well to make it known), then in such a tyme, if the plague bee in such a city as this where there is soe many Brewers to let them doe it, but if it bee scattered in the country then every particular house may doe it for themselves, because there they almost all brew their owne Beer. I mean that the Brewers should brew all their drink with alexipharmicall Herbs, roots etc., instead of Hops, but they must bee, such as may bee had in good quantityes. The Ingredients are these, viz., Carduus, Scordium, Scabious, Aron leaves, Burdocks, Angelica, Southernwood, pimpernell, wormwood, Goats' rue, Marigold, Elicompane leaves or roots, Juniper berries, enough to bee had, Walnut leaves or the tender boughs, and many more might bee reckoned, but all these may bee had in quantityes great enough, and yet are not any of them soe ill tasted but that they are all tolerable in drink, though they were all brewed together. I have forborne to name rue, because it is soe strong in taste and smell, and it is so dear and scarce to bee had, especially in a plague. They that can abide it and have it growing may make use of it. Scordium also is commonly dear, which may be left out if not easily had, though it is one of the best of them.

But to make as short work about medicines as may bee, because every book is soe full of them, I will only sum up all those particular Simples which I judge are good, out of which you may make compositions at your pleasure; afterwards I will set downe 5 or 6 compositions of my own that I have made use and trial of this last year, and soe proceed to the Method of Cure. The simples are these following, viz., *Rootes*—The Rootes of Scorzonera, Tormentill, Meum, Nard Celtick and Indian, Masterwort, Cinquefoile, Ginger, Petasite, Valerian, Sulphurwort, Zedoary, Leekes, Onions, Garlick, Sarsaparilla, Aron, Vipers' Buglosse, Elicompane, Virginia Snake weede, Dragon roots, Ash, Galangall, Hyacinth, Orris, Docke, Dittany, Cyprus Root, Costus uterque, Selondia, Avens, Calamus aromaticus, Buglosse and Burrage, Bistort, Behen, Burdock, Aristolochia, Gentian, Acorus, Angelica.

Herbs—As Pimpernell, Chervill, Centaury, Carduus, Goats' Rue, Marigolds, Burrage, Bettony, Costmary, Mugwort, Woodroofe, Marjoram, Agnus Castus, Woodsorrell, Common Sorrell, Southernwood, Wormwood, Germander, Camomill, Dittany of Crete, St. John's wort, Lavender, Cotton, Bayes, Balme, Mints, Tobacco, Bazill, Plantain, Polium, Roses red, Rosemary, Rue Sage, Savory, Scabious, Schœnanthus,

Scordium, Tyme, Divell's bitt, Mead sweet. *Woods*—Lignum Aloes, Balsom wood, Sassafras, Juniper, Box, Walnut tree, Guaiacum; *Barks*—Lemon peele, Citron and Orange Peeles. *Flowers*—as Gilliflowers, Orange Flowers, Saffron, Stockes, Elder, Violetts.

Fruits—As Oranges, Pipins, Pearmains, Bayberries, Barberries, Cloves, Carpobalsamum, Pomecitrons, Cubebs, Walnutts, Pomegranetts, Lemons, Nutmeggs, Pepper, Currants.

Seeds—Sorrell seeds, Bishopswood, Amomum, Dill, Cardamoms, Daucus Creticus, Gith, Macedonian Parsley, Wormwood, Seseleos.

Gumms—As Assafetida, Bdellium, Balsam, Camphire, Galbanum, Mirrh, Storax, Olibanum.

Vinegar, Succus Kermes, white wine and canary, agaricke, sparrows, scorpions, vipers, hart's horne, unicorn's horne, bone of a stagg's hart, castor, bezoar, silke, amber greece, red corrall, pearles, antimonium diaphoreticum, gold, silver, bole armeniacke, terra sigillata, terra Samia, lapis granatus, rubinus, saphir, emerald, sulphur.

Compound Medicines good against the Plague are Acetum Caryophylorum, Acetum theriacale, Aq. Absynthii Comp., Aqua Angelicæ Comp., Aq. Bezoartica, Aq. Cord. frigida Saxoniæ, Aq. Gentianæ, Aq. imperialis, Aq. Juglandium, Aq. Celestis Mariæ, Aq. Melissæ, Aqua mirabilis, Aqua petasitidis Comp., Aq. Scordii Comp., Aq. Theriacalis, Aromaticum Caryophilatum, Aromaticum Rosatum, Confectio Alchermes, Confect. de Hyacintho, Diacinnamum, Diacorallion, Diarrhodon Abbatis, Diasatyrion, Diascordium, Electuarium de bacc. lauri, Elect. de ovo, Elect. e sassaphras, Extractum theriacale, Extract. Bezoardicum, Julepum Cardiacum, Laudanum Londinense (Pulvis), Lætificans, Mithridatium, Philonium Magistrale, Persicum, Romanum; Pulvis antilyssus, Pulv. rad. ari Comp., Pulv. Bezoardic. magist., Pulv. e chelis canc., Saccharum tabulat. perlatum; Species Cord. temperatæ, Sp. diamargariton frigidi, Sp. diambræ, Sp. diatrion pipereon; Spirit Castorei, Sp. lavendulæ, Syrup. acetosus Comp., Syr. e Cort et e succ. Citri, Syr. e coralliis Comp., Syr melissophyli, Syr. de stœchade, Theriaca Andromachi, Th. Diatessaron, Theriaca Londinensis, Tinctura Croci, Tinctura Theriacalis, Trochisci Alexiterii, Troch. de Camphora, Cypheos, Hedychroi, de ligno Aloës, Troch. de vipera; Vinum Absynthites, Vin. scilliticum.

Then you are to take notice also that the same medicines are to bee used both for curing the Plague and preserving from it (except only in the cure you are not

to use any of the purging Medicines at the beginning nor middle of the disease, though they bee never soe gentle, till eight, 10 or 12 dayes bee over, but generally not till the sores have done running), soe that all these Medicines, both simple and compound, are effectual not only to preserve from the disease, but also to cure it. Soe that when I come to speake of the Cure I shall have occasion to write down but few Medicines, because I have named them here before. Besides many other boobies have saved mee the Labour, and especially Diemerbrook, whose book, as well as many others, is crowded with Medicines, but his are all very good, though too tedious. A few Compound Medicines will serve him in his Practize, half-a-dozen good ones are enough in Reason. I will only add 4 or 5 Compound Medicines of my own which I used all the year with good successe, and soe make an end of preservatives. I used none but my own commonly, for I had not seen Diemerbrook nor heard of him till of late, till my practize was all done. Since Christmas last, when the Plague began to grow thick, I made a few Medicines which might serve for a general use, as an Electuary Antidote, a Plague water, Lozenges, an Antipestilential Tincture, Ingredients for Posset drinke, to keep ready mixt, an Extract, a Pultisse, a Playster.

The Electuary was this:—℞. rad. Angelicæ, Ari, bacc. Juniperi per liberum excret, fol rutæ ana ℥ii rad. Serpentariæ, Contrayervæ, Tormentillæ, Zedoariæ, Costi dulcis, Enulæ, gentianæ, imperatoriæ, seminum Acetosæ, sem. Citri, cort. extern citri, sem. cardui, Cinnamoni, Dictamni cretici, boli armeni, Castorii, fol. scordii, gummi guaiaci, flor. calendulæ ana ℥ s.s. croci, balsami peruv., cochinelæ, Myrrhæ, caryophyllorum, troch. de vipera ana ℥ii Bezoar Orientall, Camphoræ, lactis sulphuris, ana ℨ s.s. Saccharum Triplum dissolut. in aq. Theriacali q. s. f. Electuarium.

Two Drams of this Electuary is enough to take in a morning, or a Dram and half to bee constant every Day. I took nothing else all this year but only about 2 Drams of this in a morning and sometymes I carried the Lozenges about mee to eat as I went into infected houses, but at last I left them off quite; having soe many to visit, I could not remember to use them, being all day out of one house into another, from six a clocke in the morning till ten at night. This Antidote I sold to many both in ye parish and other places, and whosoever tooke it constantly and carefully kept well for the most part, and if they chanced to have the disease it commonly seized them but on the outward parts of the body without being sick at all with it, and then they never dyed.

I used this also for Cure as well as preservation, for 'tis as good for one as the other. I used betwixt 30 and 40 lb. of this in a month. The Plague water with which I used to make cordialls and Juleps, or to mix them was this:

℞. rad enulæ, bardanæ, petasitidis, angelicæ ana lb s.s. baccar Juniperi lb i s.s. rad. tormentil., iridis, gentianæ, acetosæ, ana ʒ ii fol scabiosæ, dracontii, angelicæ, abrotoni, scordii, cardui; frondes ulmariæ, thymi, absinthii, pimpinellæ, melissæ, galegæ; flor. tunicæ, calendulæ ana m. ii. rutæ viridis m. vi aurantior. Civil. No. xii, sem. thlaspios, acetosæ, citri, pœoniæ, ana ʒ i s.s. Cinnamoni, croci, ana ʒ i Caryophyllorum, Zedoariæ, rad. serpentariæ, ana ʒ s.s. contusa macerentur in alâ novâ et vino albo ana q.s. vel lb. x et alembico distillentur.

FOR LOZENGES.

Those Trochisci alexiterii of Renodeus in the old Dispensatory are very good ones, but not soe pleasant as those in the new dispensatory, though much more effectuall in my mind, it being methinks very ridiculous to put pulv. e chelis cancrorum and bole armeniack into a Lozenge to bee held in the mouth, but those which I used were these:

℞. Rad. iridis, dictamni albi, zedoariæ, angelicæ, caryophyllorum, nuc. moschatæ, rad ari, enulæ, cinnamoni, sem. citri excorticat. ana ʒ i croci ʒ i, camphoræ ℈ s.s. sacchari albi dissolut. in aq. Theriacali lb. s.s.; f. tabulæ ore continendæ et sensim deglutiendæ.

THE TINCTURE WAS THIS:—

℞. rad. angelicæ, baccar. Juniperi, rad. tormentillæ, enulæ, Zedoariæ, imperatoriæ ana ʒ s.s. fol. cardui, rutæ, scordii, pimpinellæ, flor. calendulæ ana m. i, Cinnamoni, croci, cochinellæ, Caryophyllorum, granorum Kermes, nucis moschatæ, cort. citri, fol. menthæ ana ʒ i Infunde aceti vini albi acerrmi lb. ii et reservetur ad usum. This is good to mix with Cordialls to provoke sweat and stay vomiting.

THE INGREDIENTS FOR POSSET DRINKS ARE THESE:—

℞. rad. scorzoneræ, acetosæ, tormentill., cort fraxini, rad. bardanæ, baccar, juniperi, ras. cornu cervi, flor. calendulæ fol. lujulæ, sem. cardui, fol. scabiosæ, pimpinellæ ana ʒ ii macis ʒ s.s. M. coquentur in possetulâ pro potû ordinario.

THE EXTRACT.

℞. Rad. imperatoriæ, angelicæ Hyspanicæ, enulæ, baccar. juniperi ana ʒ iiii folior, scordii, rutæ, cardui, ana M. ii

flor. centaurii, calendulæ ana ℥ macis ℥ 1, charyophyllar, croci ana ℥ s.s., succi Jugland. Melissæ ana lb. i, vini albi et hyspanici ana lb. ii post insolationem 3 dierum coquentur leviter, exprimentur prelo et in extract. molle reducentur. Of this may bee given a Dram or more or less to provoke sweat or for a preservative, for it will doe for both. Only you must give bigger doses for cure than for preservation.

There are commonly many ingredients in several sorts of Treacle waters, alexitericall waters, and other waters which will not ascend in distillation, but will deposit their virtues in infusions or Decoctions, and therefore I think it better to make the infusions or Decoctions such as will keep, being strained cleare than to still them into water; but in a plague tyme they may bee tolerated, and thus you may doe by Treacle water because of the Juice of Lemons which is in it.

THE PULTESSE.

℞. rad. altheæ, lilliorum. alb., ceparum tost, rad. Symphiti recentis, ana ℥ ii fol. malvæ m ii flor chamæmeli, meliloti ana m i sem. lini et sinapeos pulv. ana ℥ croci pulv ℥ ii Terebinthinæ ℥ s.s. vitell ovorum No. ii ol. lini et lillior. alb. ana ℥ iii unguenti basilici et ægyptiaci ana ℥ i M. f. pulticula.

THE PLAYSTER.

℞. Emplast de mucilaginibus, terebinthinæ venet., galban colat., picis. burgund., ana ℥ sem. lini pulv. ℥ croci ℥ ii M.

I found by often experience that white bread, milk and saffron would digest and break risings as soon as anything with great ease and speed, especially those behind the ears. Pultesses are very fitt for Buboes, but that they will not lye on them handsomely and fall off again, unless they can bee bound on as they may on a legg or an arm; for it is judged they doe not constipate the pores soe much as playsters doe, but leave more scope for the venemous exhalations to breath out, which the pultesse moderately moves towards the place. They that affect to pick and choose amongst a multitude of medicines either for preservation or cure may find them enough in every author which have writt of the Disease, especially in Diemerbrook, where there is a great heap of medicines, and most of them very good, which will save mee a great labour.

And thus I will make end of preservatives, only for a farewell advise people to five or six general rules (for they are commonly confounded with a multitude), and these are only negatives; as to forbear too much fear, fullness, exces-

sive drinking and intemperate eating, bleeding, venery, purges and vomits, overtiring and overheating the body, all suddain changes in food, exercise and sleep, passions or affections; and run into noe more dangers than lawful necessity forceth you to doe. You may goe into any infected Town or house if you bee not fearfull and stay not long in the place, as not above two houres in a Towne, or half an hour in a house. If you have a good friend lying on his death-bed, and you have business of great importance with him, you may first drink half a pint of sack or hold a clove or peece of a Nutmeg in your mouth, or Zedoary, Elicompane, and fear not to goe to him and doe your business; but if you bee very fearfull 'tis best to stay away and save your life though you lose a legacy. One thing more I thinke fit to advise you concerning bleeding, that in the tyme of the Plague, 'tis not good to let blood for any disease whatsoever, for all feavers, pleurisies and hot diseases presently turn into the Plague, and the sooner a great deal if they bee blooded, and they seldom let blood for any other than hot distempers. Some have been let blood for a pleurisy and after some few days and sometymes hours have dyed of the Plague as I have seen, and people presently run to purging and some to bleeding for prevention of the disease as they think, and this is one thing which makes the disease increase after their coming in.

One thing more which I think fit to advise you of, because I have seen the experience of it in my self and others; to change your Antidotes if you bee of a dry constitution of body. For the constant taking of hot and dry Antidotes against the disease begets several diseases upon the body; especially, stone, gravel, sand, by overheating the kidneys, together with consumptions, jaundice, feavers, headache, inflammations, hecticks, nauseousness of stomack, heartburnings and many pustules outwardly. But it doth rather incline people towards such diseases than wholly bring them into them, for I never knew any dye of any disease they caught by taking of Antidotes. But I think it best for such people to take but twice or thrice a week of hot strong Antidotes as Mithridate, Venice Treacle, London Treacle, Elect. de ovo, Antidote Matthioli or that before written, and three or four tymes a week to take some other cooler Antidote, as such a one as this:

℞. Conserv. berberorum, lujulæ, pulpæ radicum scorzoneræ recentis, pulpæ baccar. juniperi ana ℥ ii Boli armeni, rad. tormentillæ, sem. citri excort., sem. acetosæ, spir. Cordial temperat. ana ℥ ii confect. de Hyacintho et Alchermes ana ℥ flor. sulphuris ℥ s.s. camphoræ ℥ i, syr. e succo Citri q. s. f.

Electuarium. They may take of this and sometymes of the other electuary first written.

I took of none but the former hot electuary because I perceived noe ill effect it wrought till after long taking; only it would make one have some sickish qualmes on the stomach about an hour after taking of it, and would drive out a many pimples in several parts of the body. As Diemerbrook also saith; the same pimples, their Antidotes drove out in Holland upon sound people. But I used my self to eat a great deal of fruit in Summer tyme as Cherryes, Peares, Apples, etc. notwithstanding they are cryed against soe much, that by their moysture and coldness they might temper and allay the effects of the hot dry Antidote.

CHAPTER XX.

OF CURE IN GENERALL.

Mr. Garencières saith the Plague is the easiest disease in the world to cure, and soe said Mr. Stoakes the Apothecary though he dared not venture on it, but hee is dead since. But whoever thinks like Mr. Garencières to cure 19 of 20 only with sweating reiterated or by taking of Venice Treacle will miss their mark I believe, and Diemerbrook himself mee thinkes lays a little too much stress upon that one common way of often repeated sweating, and yet confesseth this oft fayled of which hee expected most success. I thinke both hee and this City last year made it too universal a rule to bee put in practize upon all bodyes at all tymes of whatsoever age, complexion, season, constitution, for though some doe think (and the Chymists especially) that *in Morbis acutis complexiones non considerantur* yet I incline to the other opinion; for if a choleric and a phlegmatic man have each of them a pleurisy or a fever they will not alter their course in the cures of both, seeing one may bee cured of both diseases without bleeding, as I have oft tryed.

Some physitians here followed Diemerbrook as neere as they could; sweating was the most generall course taken, yet were not other ways left unattempted by rude and ignorant people, as purging, vomiting, bleeding. For the physitians almost all going out of Town left the poor people for a prey to these devouring blunt fellows, blind Bayards, who were very bold to turn Doctors. The absence of those who should have watched over the people's lives handed them the opportunity by their going aside, and these were all such timber-headed

fellows that notwithstanding their confident fearless familiarity they could make noe accurate observations at all, which the Physitians could easily have done, had they the same courage, and the new upstart Empiricks made sad work both with people's bodyes and purses, selling their idle medicines at an extraordinary dear rate. One sold purging pills at half a crown a pill, and an ointment at 5d. an ounce, these also sold pomanders very dear and playsters 5 Shillings a piece. One gave Mathews his pill to sweat, made with hellebore, opium, etc., which choaked people. A wheelwright and a shoe maker used these. I happened into the company of one of them, who bragged much of a water hee had. I asked him which way the water would effect the cure, and hee told mee by purging, vomiting and bleeding all at a tyme. One Gray, a quaker in Gutter lane, gave purging Pills to all that came to him; a great many also that would not venture in the battle would hold themselves excused by writing single sheets of directions out of charity, which did as much hurt as the Mountebanke; for though they never saw one sick yet would undertake to write that vomits was the only way, others that bleeding was good. Some were for purging, but not to regard what they did here or beyond seas, or what authors have writ, most of which run presently to bleeding (except Diemerbrook, who hath straitly condemned that course and hath done well in doing soe), yet hee sweated all. Yet hee had but thirty odd lives for foure score which dyed as his history sheweth.

I shall only here shew my opinion and leave everyone to chose to follow either this or what liketh them best. The whole Cure I think may bee divided into Regiment and Medicine, and the first mee thinks is the difficultest of the two to resolve, for wee are not soe ignorant in the matter as the method, in the what, as the how, though wee are not soe exquisite at that neither. Notwithstanding wee have Cartloads of receipts yet few of any great certainty, nor are like to have soe long as wee keep ourselves in the Fetters of long tedious compositions. But the order of Cure soe much as concerns Method I will divide into meat, drink, and government, and first what meat and drink is fit. All substantial food, as flesh, fish, bread, eggs, etc., for the first 3 or 4 days must bee avoided and most commonly 6 or 7 days, especially if there bee a feaver, and keep only to warm spoonemeats, in which you may infuse or decoct Mace, Sorrell, Hartshorne, Cinnamon, Marigolds, Wood sorrell, Currants, Oranges, Lemons, Marmelade, Tamarinds, Barberries, Prunelloes, candied Angelica Stalks, red roses,

Chicken, Larks, Partridges, Sparrows, Burrage, Buglosse, Cowslip flowers, Sage, Rosemary, gilly flowers, Juniper berryes, Scorzonera roots, Nutmeggs, Pippins, Betany, Marjoram, Saffron, Mints, Savory, Tyme or what you will; any of these, according as the patient is troubled either with vomiting, Frenzy, Faintness, Feaver, windiness. The poor must make a shift with Panadoes, made with some of these things in it. They that are rich may make themselves other Cordiall broths more costly as thus:

Take a Chick or young Capon, or Partridge and three or foure Larks, the intralls taken out, adding some veal knuckles also an Orange and Lemon cut into slices with peel and seeds and all, or a whole Citron if it bee the tyme of the year that you can get them, or if it bee not you may take the Candied flesh of them, half a pound, fresh scorzonera roots, scraped, candied orange roots and Angelica stalks candied, of each two ounces. Conserve of Roses, Barberries, and quinces, of each 2 ounces, Cinnamon, half an ounce, Mace two drams, Hartshorn an ounce, boyl these together in a quart of water, and a quart of white wine, or as much of each as will conveniently serve (for I am noe cook). You must boyle it a pretty while, as an hour, or an hour and a half, then strain it through some cloth, and if you will press it out in a press, of this the sick may take 6 or 7 spoonfuls 4 or 5 tymes a day.

I think I need not write much of this nature seeing every Nurse knows or ought to know how to order their dyet which differs nothing from the order to bee observed in the Small Pox. You must give nothing cold either meat or drink, but warm both. For Drink at the beginning of the disease it should bee something smaller then after, as one part strong beer, and 2 parts small, but forbear large draughts though you drink the oftener, and commonly posset drink boyled with some of the things in it I mentioned but now before. The Broth Posset Drink turned only with Oyle of Sulphur is highly commended by some, also Oranges and Lemons and Wood sorrell are good if great feaver and thirstiness trouble them, but in the posset you give them in their sweats, you had best to boyl Scabious, Carduus, Marygolds, Juniper Berries, Hartshorne and the like. Possets made with white wine or Cawdles with it are to bee commended, if there bee much feaver you may make such Juleps as these to drink now and then instead of Beer:

℞. Aq. Cardui, lujulæ ana ℥ iiii Aq. theriacale, Aq. Cord. frigid. saxoniæ, Cinnamoni hordeati ana ℥ ii succi aurantior ℥ iii Syr. e succo Citri ℥ iiii M.

If it bee for poore people this will serve:

℞. pomorum redolent nº 6, lujulæ M. ii Coq. in aq. font. lb. iii adde succi aurant ʒ iii sacchari ʒ ii m.; let them drink this instead of beere.

At the beginning of the disease you must make your Cordialls more expensive especially if you trust to them to eject the disease without Antidotall electuaries or Powders, for some people cannot take electuaries or Powders, neither in Bole nor Potions, then you may make them such a potion as this:

℞. Aq. Antipestilential ante prescript ʒ iiii aq. Theriacal still. ʒ ii spirit. croci ʒ i aq. Bezoard ʒ ii s.s. syr. e cortic. Citri et fl. Caryophyllor. ana ʒ i olei sulphuris gt xii m. capiat dimid. initio morbi et reliq. intra horas tres.

If the Party bee troubled with constant vomiting you may make such a Julep in stead of beer, and in this disease nothing is better to deny themselves much drinke, or drinke small draughts of this Julep.

℞. Aq. lujulæ, Citri totius ana ʒ iiii aq. Cinnamoni hordeati, menthæ, rosar. rub., ana ʒ s.s. succi aurantior civil. ʒ ii Syrupi e succo Cydonior ʒ ii s.s. ol. vitrioli gt xii m. capiat C ii quâque horâ. If they bee disposed to bee loose which is dangerous such Julep as this will doe well:

℞. Rad. tormentillæ, acetosæ, Symphiti, Scorzoneræ, ana ʒ i fol. lujulæ, centinodii ana Mi, rosar. rub. M. ii cornu cervini, eboris, ana ʒ i Cinnamoni ʒ s.s. Coq. aq. fervent et vino albo ana C s.s. ad lb. i s.s. Colaturæ adde Syrupi de rosis siccis, Syr. myrtini ana ʒ ii ol. vitrioli gt xx m. Cap. cochlearia sex ter quaterve in die.

For continuall vomiting you may apply outward Cordiall and stomachicall Epithemes to the stomach, or soake a Tost in Vinegar, with Nutmegg, and lett them smell to it and chaw it, or clap a stomachicall playster all over the stomach, such a one as this:

℞. Emp. Stomach. magistral ʒ i s.s. mastiches et Taccamahac pulv. ana ℥ i aromatici rosat ℥ i s.s. ol. Moschati ʒ ii ol. Cinnamoni et Menthæ Chymic ana gt xvi m. extende alutâ tenui et stomacho applicetur.

And this Julep now and then:

℞. Aceti Theriacalis prescripti in tinctura ʒ aq. Cydonior., Cinnamoni seu menthæ rosar. rub. ana ʒ i Succi Cydon. si habere poterit ʒ syr. Cardiaci et de Mentha Comp. ana ʒ i s.s. m.

Some condemn the use of wine either for preservation or cure, perhaps thinking it inclines them to sleepe, or thirst, or feavers, or perhaps, judging as Rondeletius doth, that it carries venome the swifter to the vitalls; for hee saith hem-

lock given in wine kills speedily, but in water slowly, though I believe not that hee ever tryed it either way; but people come at things, and then publish them for truth. I cannot dislike the use of any good wine, as Canary or Rhenish, given only to fit persons in due tyme and quantity either for preservation or cure, if it bee not just in the beginning of the disease, nor the patient very sleepy or have a high feaver, or in hot weather, or bee a cholerick person, or frantick or light-headed, or have a great pain in the head, or thirstiness, or inflammations, or bee a child, in such cases it is to bee forborne; but to others free to bee used especially for preservation, for there is scarce a better Cordiall to bee found that growes in soe great a quantity amongst all Simples, and doth much good in a plague tyme by expelling feare and melancholy, or you may mix a Cordiall with it as thus:

℞. Vini Canarini lb. s.s. aqua boraginis, Cinnamoni hordeati, ana ʒ iiii Syr. e Succo Lujulæ, berberorum, Idei rub., e Succo citri ana ʒ i aq. rosar. dam. ʒ ii M.

Now concerning the Method of ordering of a Person in his Sickness from the tyme of his falling sick to his going abroad again, in this lyes all the Art and difficulty, and I was once in the mind to have sayd nothing at all concerning this, fearing my weakness and inability to perform it least I should commit some errors about it, which might endamage the publick safety of mankind. But seeing this is most materiall, and the booke bee imperfect without it, I thought good to lett people know my opinion concerning it, for I doe not desire any one should pin his faith upon my sleeve in this particular. Much less doe I undertake to give a generall rule to the world to walk by, but leave every one to his choice to goe his owne way, for soe many various circumstances arise upon severall persons at different tymes, Ages and Seasons, that it is an endless and almost impossible thing to treat of all particulars, but only lay downe a few generall rules to keep people from the more gross errors which are most dangerous, and leave the more nice particulars to bee ordered according to the present occasion and skill of the Physitian. Therefore, first, the total avoyding of bleeding, purging, and vomiting as most pernicious and destructive by what meanes soever procured, or by whomsoever practized or commended, by writing or otherwise; for though there bee 30 or 40 Authors which have commended bleeding, there are as many or more which condemn it, besides continuall experience. Besides these, common reasons are enough to confute all Arguments which can be raised in defence of bleeding, as:—

1. Because the Plague is not bred either from plethora or cacochymia, from plenitude or corruption of humors, nor obstructions or anything within the body, though such things are sometymes the occasions of sooner taking it, but from the outward Infection in the Air or other Subjects.

2. The Infection doth not allwaies float upon the humors nor spirits, though most tymes a little mixed with them, but sticks to the Internall solid parts, and therefore will not swim out with bleeding or purging, nor be wafted off with sweating many tymes.

3. But few have any feaver, and those that have any have it not properly or originally, by reason of the pestilent venome, but of the Putrifaction of humours, which is caused by that, and you must have a greater eye to the Plague then to the Feaver for this hardly kills any (of the Plague) simple of itselfe, but as it is joyned with the Pest, and soe makes the burden heavyer to bee borne, and the Patient sooner to bee ruined, especially at the beginning of the disease.

4. You doe the greatest injury to the patient that can bee, because Nature raiseth this in the body on purpose to help herself withall, to help to thrust out the disease to the superficies, and I saw all along that they who had a pretty high feaver at the beginning of the disease usually fared best, wherefore I never meddled with the feaver till three or four dayes were over and the disease pretty well thrust out; but a feaver happening in the middle of the disease, or three or four dayes after falling sicke, was dangerous.

5. Because the main thing to bee designed at in this distemper (and almost in all others) is to preserve the spirits and strength of the body that nature may make the strongest expulsion; but bleeding renders them weak, languid, and flagging, and nothing more diminisheth them.

6. Because bleeding quite overthrows the laudable designe of Nature by perverting her course, which is to drive the matter offending from the Centre to the Circumference, and from the noble to the ignoble parts; whereas this turns in the venome again, as may easily bee perceived by people's growing soe faint and dying soe suddainly after bleeding or spontaneous sudden loosenesse.

7. Because it checks the expulsive faculty soe much and makes all outward eruptions to fall flatt, black or blewish, which should by all means bee raised.

8. Because by it the spirits and humors being disturbed are more prone to take the infection, and scatter it, which perhaps was gathering to one place before.

9. Because perhaps before the venome only lodged in some

outward or ignoble part, and now after bleeding the empty veins receive it into themselves and soe transmitt it into the Intralls.

10. Because Hypocrates teaches us to follow the intentions of nature, and alwaies to drive a disease that way which she is most willing to, and most readily points out, and in this and almost all other venoms, she thrusts them out to the outside of the body, into boyles, scabbs, Itch, pimples, etc., and these same arguments will serve against vomiting and purging, and wee see experience enough that whether they bee procured by art or nature, if a vomiting cannot bee staid or if they fall into a loosenesse they allwaies dye.

CHAPTER XXI.

THE METHOD OF CURES.

Before I begin this I must needs say something concerning a doubt which hangs in my mind, which I have hinted at a little once or twice before, viz., whether strong sweats often repeated be an authenticall canonicall rule which will serve for all sorts of people or noe. I wish some body of more skill would resolve the doubt. That which makes mee doubt and stick concerning this is that I have seen soe many this year of strong, lean, rawboned, nervous people of much spirit and little humor, that have been very laudably sweated, and scarce one in twenty of them have lived, but dyed all within two or three days, and the sooner by how much the more freely they sweated, and were the worse after their sweating, being much more subject to lightness of head, staggering, faintness, bleeding at the nose, quinzies in the throat, and some had the tokens come out presently, which made mee desist from much sweating such persons. And then I had many patients, lusty men, that lived, which I never sweat at all, and are living to testify the same. And I observed that they that sweated very freely of their own accords seldom lived. But let not any think that I goe about to decry the common way, which of all the four vacuations is surely the safest; I speak only in reference to one particular constitution of people, that others may take the more notice of it. So I will not say noe more about it, but now turn to describe the whole method of ordinary sick persons from their falling sick to their going abroad.

First, when you have concluded any one from manifest signes to have the Plague, let him or her goe into a warm

bed in a close chamber with a fire in it, which must be bigger in the winter and less in the summer. In the summer you may strew or rub the room with cold sweet herbs and in the winter with hott, or sprinkle it with Vinegar or Rose water (but these things are of least consequence) then presently give the party some alexipharmick bole or Potion, which is more convenient then a bole unless they bee inclined to vomiting, then a bole will stick best, and if they vomit it up, give another, but alter it a little, and let them hold a spoonfull of wine vinegar in their mouths and smell to some besides. Then appoint this, let him or her sweat an hour or an hour and half 2 or 3 tymes, according as circumstances permit, as they are strong or weak, fat or leane, hott or cold tempered, old or young, or middle aged, the season of the yeare, the weather, the strength of the disease, the sexe, the forwardness or backwardness to sweate, in these things the discretion of the overseer must direct. But sweat not 24 houres as some appoint. Then in sweating drink such posset drink as was prescribed before, a Carduus or Juniper posset, if you cannot get all the other things, and have by you a convenient Cordiall Julep, to drink now and then, and if they will not sweat easily with medicines and coverings you must apply hot things to the outsides of their bodyes, as bricks wrapped up in napkins, bottles or bladders of hot water; or baggs of sand heated or any mettall. You may apply these to the armpitts or groine; the head must have a cap or a napkin about it.

And after sweating and all well dryed you may open the North or East windowes halfe an houre to diffiate the evill fumes or vapours of the chamber, but change not their shift or bed clothes unless for foul ones worn before and well ayred again (for this is a very ticklish disease and the least error committed turnes a man out of dores) untill a fortnight bee over at least. But if you see noe fair eruptions come forth, nor the party bee not better after the sweat, but ill signes continue still, you must give another dose of Antidote, and sweat again after 6 or 8 houres, according as hee sweat more or less before, and lay on two strong large blistring playsters to the inside of his arms a little below his shoulders, for there they doe alwaies more good than on the wrists, and six or seven houres after hee hath sweated take them off againe, and dresse them twice a day with Burgundy Pitch and Melilot playster mixt together, or either single as they are more hardy or tender. And if the buboes come not forth well nor you can perceive noe blaines or carbuncles arise any where else, you may apply blistering playsters to the Emunctories; then when you perceive the Inwards freed from the Infection, you may give the patient

some kind of small nourishment, or tender meates of lightest digestion, and now and then a little Cordiall, and sometymes a little Antidote without sweating. Some after they have given the first dose to sweat upon, give another of the same within two houres, and a third or a fourth at little distances of tyme all the while they sweat, both the first, second and third sweats, but if after this second sweat you perceive little success and the party continues either with belching, vomiting or looseness, giddy-headed, lisping, thirstyness, sick faint fitts, feaverish oppression or stopping at stomach, hiccough, bad pulse, stiff neck, restless or some settled pain in some particular part, that will not remove; if any of these or other ill signes appeare, then you may if you think good take the other bout at sweating. But it is seldome that the third or fourth sweate doth any good, if the first or second doth not, but in sweating a patient have a care of making him weak and faint, for it were better in my mind that they were not sweated at all then to have their strength overthrown, and have care of their drowsing and sleeping in their sweating, especially at the beginning of their disease.

CHAPTER XXII.

THE CURE OF CONCOMITANT SYMPTOMES JOYNED TO THE PLAGUE, AND FIRST OF THE FEAVER.

The feaver I told you before must not bee much meddled with at the begining for fear of hindring the cure of the Plague, but if it remain long and increase and threaten the party, then you may use the same Medicines, but not the same method, for you must not purge, bleed, nor vomit nor glister, which you doe in other Feavers, only in the Medicines you must have an eye to the pest, therefore I shall say noe more to this, seing the usuall Medicines good for the Plague, which are of the cooler sort, will serve for the Feaver, as Wood Sorrell, Barberies, Oranges, Citrons, Scorzonera, Tormentill, Plantane, Borage, Sour Granates, Violetts, Sorrell seeds, Bole, Camphir, ol. Sulphuris, Vitrioli, Salis, Corall, Ivory, Pearls, Nitre, Lapis, Hyacinthus.

Of Headache, too much Sleeping, Watching and Frenzy.

The headache usually lasted not long but somtymes it was soe grievous that it required particular care and cure, and this is easily done by Frontalls and unguents, and a few Cephalicks used inwardly; if need bee such an unguent as this often prevails:

℞. Ung. populei ℥iii ol. nuc. moschat. per expressionem ℈ii Camphoræ ℈s.s. Opii gran. ii spirit. rosar. gr. ii M. f. linimentum pro fronte.

Or Red-rose Oake soaked in red-rose Vinegar with a little Nutmegg and Camphire applyed, and if such things will not doe, you may apply a strong Vesicatory to the necke or a Cupping-glass without scarification. The Ointment will serve for watching and frenzies, and the Vesicatory and Cupping will serve for drowsiness and too much sleeping. If you think not these enough you may make any other kinds of medicines out of the simples good for the purpose, as some of these, viz.:—Roots of Piony, Zedoary, Marjoram, Misleto, Bettony, Cowslipps, Lavender, Goats' Rue, Yew-berries, Masterwort, Tobacco, Popyes, Sage, Willow, Stæchas, Nymphea, Nigella, Juniper, Black Cherryes, Gum elemi, Taccamacha, Nutmegg, Castor, Cloves, Rosemary, Lime-tree Flowers, Bayberries. Applications to the feet may bee tolerated also for diseases in the head. They that are inclined to sleep too much must also bee hindred from it, pulling, troubling, and talking to them, and walking about the room if they bee able. You may boyle some of these simples, as Bettony, Rosemary, Lavender, Marjoram, Castor, Stæchas, Cloves, Nutmegg, in Wine Vinegar, and inject it in the nostrills and rubb the forehead and ears with it also, or else Chymicall Oyle for anointing the temples. To divert the Drowsynes, as Oyle of Rosemary, Amber, Rue, Camomill, Castor or the like, or moderately to use sternutatives if they doe not sneeze of themselves; but these venemous vapours which ascending doe cause these sleepy inclinations are chiefly dissipated by gentle Sweates, and the eruptions coming kindly forth better then any Topicks or Cephalicks.

Fainting, weakness, and swooning are to bee cured by convenient Cordialls, Electuaries, Epithemes.

Wind, belching, and hiccoughs must bee cured (if they will admitt of cure) with such things as these:

℞. fol anethi, thymi, pulegii, satureii, ana M i. flor fumitoriæ dul., carui, anisi, anethi, charyophyllor., nucis moschat. ana ℥i coq. in possetatu; or this Powder:

℞. sem. anethi thymi, carui, cymini, anisi, ana ℥i charyophyl, Zedoarie, nuc. mosch. croci, ana ℥ s.s. camphoræ ℥ s.s. F. Sacchari ℨ iii m. f. pulvis—or this Electuary:

℞. El. de baccis Lauri, conservæ Menthæ ana ℨ i aromatic. rosat., diagalangæ ana ℥i Syr. Cardiaci q. s. f. electuarium.

To cure their vomiting was the greatest difficulty, nay, sometymes it would not bee staid for all that could bee done. To stay this vomiting divers things are to bee tryed, both

by outward and inward meanes, the most effectuall I shall here sett down:

℞. conserv. ros. rub. menthæ, berberorum ana ℥; diascordii. confect. de Hyacintho, sive mosch. ana ℥ ii Aq. pestilential. prescr. ℥ ii aq. Cydonior., menthæ, Cinnamoni seu succi limonum ana ℥ i aq. rosar. rub. ℥ i s.s. m. et stent per horam et colentur et detur. cyathum i ter. in hora una.

℞. Unguenti astringentis, ung. rosat., ol. Scorpion. ana ℥; theriacæ Andromachi, ol. nuc. mosch. per expressionem ana ℥ i s.s. ol: menthæ chym. ℈ s.s. M. f. liniment pro stomacho.

℞. Emplast. stomach. magistral. ℥ i ol. nuc. mosch. per express. ℥ i ol. Cinnamomi, menthæ chym. ana m. ℈ s.s. M.

℞. Aromatici rosati ℥ iii fol. menthæ, caryophyllor., macis, mastiches, ana ℥ i pulverizentur et adde micarum panis alb. ℥ iiii aceti rosar. et succi Cydonior. ana q. s. f. pasta mollis et ventriculi regioni applicetur.

℞. Aq. Antipestilent. prescript. ℥ iii succi cydon. et lujulæ ana ℥ i aq. Cinnamomi hordeati et aceti rosar. ana ℥ i Syr. de Symphito ℥ ii f. Julep.

℞. Cinnamomi ℥ s.s. rosar. rubr., sem. coriandri, macis ana ℥ ii Rasuræ cornu cervini et Eboris ana ℥ s.s. fol. menthæ ℥ i panis alb. ℥ i s.s. coq. aq. fount. q.s. ad lb. i Colatur adde syr. e succo Cydoniorum ℥ iii ol. vitrioli gut. xx. M.

℞. Conserv. menthæ, rosar. rub., berberorum ana ℥ ii nuc. mosch., conserv. cort. cit. cond. ana ℥ i aromatici rosati ℥ iii Elect. e sassaphras ℥ i ol. Cinnamoni gt. viii syr. rosar. sicc. q. s. ol. sulph. ℈ s.s. F. B. pistentur conserve et f. electuarium.

℞. Cinnamomi, macis, caryophyl., Cort. Citr. fol. menthæ rutæ, Mastiches, rosar. rub., santali rub. ana ℥ i sacchar. ℥ ii contunde et nodulo infunde lb. i Vini Rhen. aq. rosar. et aceti samb. ana ℥ i M.

℞. Carnis Cydonior. condit., gelatinæ Idei rub., cons. berberorum, cons. Rosar. rub., ana ℥ i M. Capiat ℥ ii pro bibitu.

I think these enough, but many more may bee made as occasion requires. Now if any think it a good way to give a vomit to help nature to vomit up all at once, thinking that then the patient will bee well, sure they are much out of the way, as they were who published such a way by their printed sheets in the summer, for it is not a commodious way for nature to cast out the disease this way, neither doth she intend it but to the superficies of the body. I gave but one Vomit all the yeare, which was to a strong man in May, 1665, who having drunk hard, had a great disposition to vomit, and did of himself, and the day after hee

took the vomit had an obscure Buboe arose in his Groine, which with his belly falling a little flatt, and giving a faint smile hee dyed presently.

THE CURE OF BLEEDING AT YE NOSE, COURSES, SPITTING OF BLOOD, PISSING OF BLOOD—PILES.

Severall Countryes produce severall effects. For Diemerbrook saith that in Guilderland at Nimuegen, where he practized, bleeding was a dangerous sign, and scarce any lived of it, but especially of spitting and pissing of blood. Now this pissing of blood was not seen at all with us, and the spitting but little; but wee had abundance that bled at the nose, and some also had their Courses yet did well. I believe a third or fourth part of them that bled lived, yet I never liked it, and had rather alwaies that it should not have happened; yet it was soe doubtfull a sign that I durst never give judgment by it; but there was noe stir made about the curing of it as Diemerbrook speaks of. But people lett it alone generally, for usually they bled but a few drops. I remember but two men at present who bled freely, one of which lived and the other dyed, viz., hee that bled at the nose, bled at the beginning of the disease two or three quarts and lived, but the other bled at the mouth two or three dayes after hee fell sick and dyed that night. Now if such bleeding happens that threatens the life you may apply such meanes as are commonly used in that case, as Bole, Red Corrall, Comfrey, Troches de terra Lemnia, Ivory, hartshorn, red roses, lap. hematites, vinegar, white Copperas, Tormentill, bistort, opium, Chalk, lyme, lead, terra sigillata, a live Toad, Iron Stone, Jasper, Topaz, Clay, cum multis aliis; and of these to make either Playsters or dipp Raggs and stop into the nose, vinegar, a plaister of lime and vinegar layd saddle-wise upon the nose together with ligatures, frictions, cupping, and many other devises too tedious to write. Soe much for this.

The flux of the belly and looseness which happened to many if it came upon them two or three dayes after their falling sick, scarce one in forty lived; but if any lived with it, it was such as had it from the beginning of their sickness, and but few of these lived neither; but seing what can must bee done, the way and method of curing these fluxes differs not much from the means and method of cure at another tyme, you may only make your Antidotes a little more restringent, and if you see it difficult to stop them you may use Opiates, as thus:

℞. Theriacæ venet. ℥ ii, boli veri, diarhod. Abbatis ana ℈ i laudani Lond. gr. ii ol. anisi gt. iiii. syr. de rosis sic. q. s. f. bolus. Or 2 drams of Diascordium with as much conserve of Roses taken at a tyme; there are abundance of Medicines both simple and compound good for this purpose which are too tedious to reckon here.

Oppression and stopping at Brest and Stomach. Though very few live when they come to these things, yet here and there one makes a shift to creep over this and many other threatning signes; but you must not goe about to cure this as you doe other stoppings in the stomach, as by squills oximells, vomits, but by apertive medicines as this:

℞. fol. Thymi puleg. ii anethi satureii M. i, rad. feniculi ℨ sem. anisi, fenil. dulc., urticæ, macis, moschat, ana ℥ ii Coq. in posseto facto ex vino alb. et lacte lb. s.s. addendo parum sacchari M. cujus bibet æger ℨ iii tertia quaque hora.

Other medicines you may make according as occasion and circumstances require, also you may cutt up a puppy dog alive and apply him warm to the brest. These remedies will also serve for faltering in the voice, also of which few live, but in that you must look well after the mouth, tongue, and throat, that they bee not too much furred, for that sometymes is the occasion of speaking untowardly, and to help that you must oft wash their mouths with mild Gargarisms, and not with rough and sharp aluminous waters which make the tongue more dry and the Patient more thirsty, or roule a little butter and sugar together, and lett them hold a little bitt of it upon their tongue, and gently melt down their throat, which will gently loosen and fetch off the black furr from the tongue and begett a more easy lubricity in the voice and throat.

The swellings and stiffness of the neck, and pain and soareness in the same, though few live of this also, if any cure bee to bee had, it is by revulsion, as by blisters on the arms. Cupping, but not upon the neck, but below the Tumor, also keeping the necke warm, and annoynting it with gentle Mollifying Oyles and Ointments.

Almost all the other evill signes, about 30 in number, will hardly admitt of any Cure, wherefore I think it needless to write anything concerning them, for what Cure can bee made upon Tokens, Buboes fallen flat, bad pulses, cold sweats, bad urine, white soft Buboes, Carbuncles, Blaines; and first of Buboes.

CHAPTER XXIII.

THE METHOD OF CUREING BUBOES AS MUCH AS CONCERNS OUTWARD CURES.

Though many Buboes after they come to bee very bigg never come to break at all, but sink away again, and by degrees wear quite away, yet doth the Patient grow well and continue soe notwithstanding their not breaking, yet you must not make it your design to repell, divert, or disguise them, but only to suppurate them, and if you see them not more forward or digest soe fast as is convenient, then you may apply a vesicatory just underneath them, that soe the pernicious Ichorous matter may have vent and these blistering Playsters had better success alwaies than Cupping or burning or potentiall Cauteryes; and you may apply once a day a fresh poultess to it if you can make it abide on, but I found them soe troublesome, that I altogether discarded the use of them, seeing there is soe much trouble in compounding, takeing off and makeing them abide on the right places, for the Buboes alwaies happen on such places as poultesses will not lye on, but fall off with turning the body. Therefore I made use of Playsters; only use more mollifying, maturitive and digestive Plaisters at first till you perceive it ripe enough, and then add some stronger and drawing Playsters or ingredients to break it withall, and then you hitt the marke, and when it is quite ripe if it doth not breake soone enough with the Plaisters, you may open it with a lance or a penknife. Some lance them while they are green and keep them running like an Issue, which is not soe commodious a way as the other. Methinks there is noe more reason for it then for a man to cutt down his Corne before it is in the ear, or gather his fruit before it is half Ripe; yet this way of lancing hard sores is not only tolerable, but convenient sometymes, as when a sore remains hard a long tyme and noe Topicall means will bring it to Concoction.

When there is any danger threatened because of the slow progress of its rising, some use to lett the Buboes alone two or three days, doing nothing to them, and afterwards begin to lay playsters and dress them, which was none of my way, for I made application to hand them forward as soone as I perceived their first budding forth, accounting it as much sense in letting them alone two or three days, as if a Middwife should see a Child at the birth,

and should say, "I will come to-morrow and deliver the woman". Would not all women say she was a cordworthy person? But here you are to take nature. These swellings that arise behind the ears and upon the Throat must not have soe strong pultesses and Playsters as you use to the other Emunctories and other places of the body, for fear of suffocation. Gentle Pultesses or Cataplasmes will serve best for the Necke, as Mallowes boyled in Milk and a little saffron and white bread will doe for them as well as anything I ever found; and for the Groin and Armpitt and other places, for somtymes they rise in other places as well as in the Emunctories, though many think not soe. this Playster will serve:

℞ Galbani vino colati, Diachili comp. cum gummi ℥ i croci ℥ i Terebinthinæ ℥ ii vel iii. M.

You may anoint the swelling allwaies a little before you put on the Playster with Oyle of Lyllies or Linseed Oyle. This Playster will serve for all intentions and purposes, soe far as concerns digesting of Buboes, and at latter end to break it you may apply only Galbanum colated, for that commonly breaks it in a few hours. The most common Playster or Mixture which the poor people used all over the Town was an egg and wheat flower and Turpentine and Honey and oyle of Lillies, which is not to bee contemned, but may doe well enough, though I never used it, but found somthing else better and cheaper for the poor people, but shall not say what, though it is noe secret. After they are broke, you may dress them twice a day with Melilote playster, and if they dry upp too fast with that, or doe not run well enough, you may add some Turpentine, and burgundy pitch, and melt them together and spread it. Some have delivered doctrines that venemous creatures and other things venemous, as Toads, Froggs, severall kinds of serpents, scorpions, Fishes, as Oysters, Mussells, and Crabs, layd to Buboes draw out all the venome, others that the Rumps of Henns, Chickens, Pigeons, and other Fowles applyed to the sores till they dye, holding their bills and putting salt on their Tails will draw out all the venome. Crowfoot stamped and applyed will draw as good blisters as Cantharides. Some apply living creatures, either Fowles or Beasts still alive. For Ripeners these simples are accounted good, Mallowes, Marshmallowes, violetts, comfrey, Berts, scabious, Camomile, onions, Leekes, Horseradish, Elicompane, Mustard, Mercury, Burdock leaves, Coleworts, Melilote, Mullein, St. John's wort, Figgs, Dates, Mithridate, Venice Treacle, lillyes, Lineseed, and Fenugreek, saffron Oyle, Wax, Honey, Turpentine, Opopanax, galbanum,

yoakes of Eggs, Loadstone, drawing Playsters with Arsenick in them, soot, salt, Leven, soape, Butter, Pidgeons' Dung, Hens' Dung.

CHAPTER XXIV.

THE CURE OF CARBUNCLES.

The outward Cure of Carbuncles must bee wrought after a different manner from Buboes, there being soe great difference betweene them in many respects, as in substance, Figure, Place, Temper, Colour, Effects; you must use mollifying maturitive Ointments to these, and such as doe not exceede in heate, but such as may modify the drynesse and mitigate the paine and burning of it, and rott it, and bring it to sheale off from the other flesh, to all which purposes such ointments as these will serve:

℞. rad. Altheæ, Symphiti ana ℥ i fol. altheæ, malvæ, scabiosæ, ana M. i pulv. sem. lini. ℥ i flor. meliloti et his etiam addendo unguenti basilici, apostolorum, ana ℥ i s.s. terebinthinæ venet., mellis, ana ℥ s.s. olei liliorum alborum ℥ i s.s. vitell. ovorum No. 2 m. f. unguentum; with this you may anoint the Carbuncle twice a day, and lay over the Plaister I mentioned before for Buboes, and at 5, 6, or 8 dayes it usually rotts and sheales off from the other flesh, but if you will not bee at the trouble of makeing this Ointment, this will doe the business well enough:

℞. unguenti basilici, Dialtheæ, Ægytiaci, olei lini., lillior albor. valent. scabiosæ, Terebinth. venet. ana ℥ i pulv. sem. lini., flor. meliloti ana ℥ i s.s. m. f. unguentum.

Some upstarts here in Towne used much to lance Carbuncles, others to cutt them round about, and then poure into the greene wound vinegar and salt, but to what purpose I know not, unlesse they delighted to torment people, for it put them to as much paine as if they had beene on a wrack, worse than Death itselfe. A Frenchman which I have heard of used to cutt them round, and pluck them out with his Pincers before they were ripe, and put them to much paine. Now both before the Carbuncle is ripe and after it is fallen of it will run very much, and after the Core is out you may dresse it with Minium playster, Meliloti, or Diachilon, for Diachilon will not heale it up too soone, as you may suppose, for it will not heale up a great while, doe what you can. Some Chirurgeons used only a little bazilicon and tow to Carbuncles, and tis likely that may serve well

enough in common, but you must not thinly and slightly annoynt the Carbuncle with these Oyntments, but lay them on thick upon the soare twice a day, because the soare is soe hott and dry; butter mixed with oyntments is good also. Many other Devises have been used about Carbuncles, as soot, salt and soape, and figgs, leven, vesicatoryes, and burning them with hot Irons, which are too madd wayes, and many other oyntments, Playsters, Pultesses and liniments not needfull to write seeing I have set downe those at first which will make sure worke. Butter of Antimony is comended to doe admirable things in makeing a Carbuncle sheale off, and keeping it from spreading further and further upon the sound flesh if you anoynt the circumference of the Carbuncles round about with it.

CHAPTER XXV.

THE CURE OF BLAINS.

When anyone falls sick of the Plague, as soone as you perceive any little red pimples arise in any part of the body or white or straw coloured with a little matter in them, like the small Pox, when they are at their full biggenesse, or a little bladder, with blackish or blewish moisture in it, then lay a Playster over it once a day at least, if not twice a day, and in about a week's tyme it will run well; and most tymes there is a little Coare in them also which will come out in a little tyme, and afterwards you may dress them with Minium Playsters. The Playsters which I wrote before for Buboes, will serve as well as anything that can bee invented to draw forth and breake and ripen these blaines, and though these little Pustles seeme but contemptible things at the first, yet when they are drawne forth, they will spread sometymes as broade as a groate or a six pence, and bee very soare and painfull, and if you neglect them and doe nothing to them, the Patient will continue sick the longer, and bee in the more danger, and somtymes dye, for want of their being well ordered.

CHAPTER XXVI.

MEDICINES FOR EXPELLING THE PLAGUE.

I will set downe here severall Doses and Medicines to bee used in expelling the Plague seeing I set downe none in the Method of Cure, neither since, out of which you may pick and

chuse which you like best. Diemerbrook makes mention against honey, sugar, saffron, hartshorne (unlesse burnt), bezoar, troches of vipers, and therefore in his expulsive cordialls never putts any syrrups, yet in electuaries he useth many Conserves and Cardits, scordium, angelica, Oyle of Vitriol, and Sulphur, and setts a high esteeme on camphore and sulphur, but thinkes crude hartshorne will signify little, unlesse it bee burnt and then it may doe something by drying, and for saffron, hee saith it troubles the head too much and heats and causeth drowsynesse, and for Bezoar, though it may bee good in Putrid Feavers and the small Pox, yet in the Plague, though hee oft gave a Dram at a tyme, yet found little successe in it, and for Troches of vipers though they bee good against venemous bitings, and Arsenick yet they bear noe antipathy against the Pestilent venome. I much dislike opium, wherefore in my Antidote I omitted it, and many in the Parish, haveing taken Mathews his Pill (soe called) were destroyed by it, by one Turner a wheelwright who gave nothing else to sweate withall, but is since dead of the Plague himself. But I digresse too much, therefore I come to those promised Receipts.*

℞. Elect. de ovo ℥ ii salis absinthii ℥ i aqua scordii comp. aq. petasitidis comp. ana ʒ ii e cort. citri ℥ vi aceti Theriacal. presc. ʒ s.s. M.

℞. Theriacæ Andromachi ℥ ii aceti rosar. ʒ s.s. Succi cardui ʒ i. ss. aq. rutæ et aq. jugland. simp. ana ʒ i s.s. M. f. haustus.

℞. Mithridatis, Theriaci Lond., Diascordii ana ℥ i aq. nuc. jugland. ʒ iiii aceti sambucini ʒ M. f. haustus.

℞. Diascordii ʒ B. aq. Cardui ʒ iiii olei Sulphuris ℈ s s m. f. haustus.

℞. Salis absinthii, cardui, rutæ, scordii ana ℈ i aq. Theriacalis, aq. calendulæ ana ʒ ii sacchari prelati ʒ i M. f. haustus.

℞. Elect. de ovo ℥ ii ol. sulphuris gt. xii confect. liberant. ℈ i M. f. bolus.

℞. Aq. Antipest. prescr. ʒ iii syrupi e succo citri ʒ i s.s. M. f. haust. pro delicatis.

℞. Aq. Theriacal aq. pestilent. ana ʒ i succi aurantior. ʒ i syr. cardiaci ʒ i confect. alchermes sive e odoriferis ℥ ii aq. ros., cinnamoni hordeat. ana ʒ M. pro delicatulis.

℞. Fol. cardui m. ii coq. in aq. fontan. q. s. ad ʒ iiii Colaturæ cui adde salis albi communis ℥ i aceti vini albi M. f. haust. pro pauperibus.

℞. Theriaca Londinensis ℥ ii vel iii aceti rosacei ʒ i aq. cardui ʒ iiii M. pro pauperibus.

* This long list of prescriptions, which is in part a repetition of what has gone before, has been somewhat abbreviated.—Editor.

℞. Aq. theriacal. stillit ℥i aq. pestilent. ℥ii aq. ros. rub., cinnamoni hordeati ana ℥i aceti rosacei ℥i syr. e succo cydonior. ℥i s.s. M. ad compescendum vomitum.

℞. Spec. cordial. temperatæ, pulv. e chel. canc. comp. speciei liberantis ana ℥s.s. aq. Citri corticis, aq. scordii comp. ana ℥i s.s. syr. limon. ℥vi si febris et carbunculus adsit.

℞. Conserv. berberorum, conserv. Cydinor., conserv. Idei rub. condit., carnis Citri, conserv. rosar. rub. lujulæ ana ℥i spec. Cordial. temperat. ℥ii syr. e succo citri q. s. f. elect. ad sedandam sitem et confortandum stomachum in febri et vomitu.

℞. Aq. Theriacal. fact. per infusionem sive distillationem ℥iiii capiat pro haustu expulsivo.

℞. Rad. angelicæ, imperatoriæ, enulæ ana ℥i fol. scordii, rutæ, cardui, scabiosæ, ana m i baccar. Juniperi ℥ii fl. calendulæ, cinnamoni, chariophillor., macis ana ℥ii coq. aq. fontana lb. ii aceti optimi vini albi ℥vi Colatura clara reservetur pro usu. Dosis ℥ii, iii vel iiii.

℞. pulv. rad. enulæ, zingiberis. flor. sulphuris sacchari albi ana ℥i M. pro pauperibus ℥i, ii vel iii secund. ætatem.

℞. Balsami sulph. ℈i croci gr. vi antimonii diaphoretici ℈B. m. deglutiat. in bolo.

℞. Sapæ cardui ℥i succi rutæ, aurantiorum ana ℥i vini alb. ℥ii syr. melissophili ℥vi m. fiat haustus.

℞. Allii contusi, theriacæ andr. ana ℥i contrayervæ ℈i M. fiat bolus pro hominibus obesis.

℞. Rad. Contrayervæ Serpentariæ Imperatoriæ Angelicæ Zeodariæ, baccarum Juniperi ana ℥i sacchari albi ℥i s.s. M. Dosis ℥i, ii vel iii.

Galen saith in a great Plague at Rome all dyed who received noe benefit by Bole Armeniacke or Venice Treacle.

As for Chymicall Medicines, you may have them out of other bookes, and more than these I judge it unnecessary to write seeing there is a daily necessity of altering Medicines according as the case of the Patient requires, and these are only for Patients to guide you in generall.

I will add but one more, which is yet defective, and I think very necessary to bee demonstrated for the avoiding relapses and many ill consequences which commonly follow the Plague, and that is a convenient purge to bee taken after they are well of the Plague, and the soares pretty well done running, and I thinke this Purging Apozeme will fitly serve the purpose instead of a multitude of severall kindes of Purges which might bee prescribed. Take a quarter of a pint more or lesse according to age and strength once in a weeke, 2 or 3 weeks together.

℞ Rad. Angelicæ, imperatoriæ, Enulæ, baccarum Juniperi ana ℥i scabiosæ scordii ana rad. scorzoneræ, ℥ ii zedoarie Caryophillor., nuc. mosch., fl. calendulæ ana ℥ii Coquentur aquæ Cardui et vini albi ana lb. i colaturæ lb. ii infunde fol. sennæ ℥ iii rhabarbari, epithymi, mechoacanæ, turpethi, hermodactillor. ana ℥ s.s. salis tartari ℥ii post infusionem debitam colentur strenue et add. syr. de cichor. et rhabarbaro, syrup. magistral. ad melancholiam ana ℥ii spirit. croci ℥i m. f. Apozema.

That it is possible to have the disease 2 or 3 tymes in a yeare hath beene proved this yeare many tymes to bee true, and that some have dyed the third tyme of their having it. Yet I question whether they were seized afresh alwayes with the plague after it had beene once throughly cured, and their bodyes cleane ridded of it, but rather that some reliques or remainders of the infection lay dormant in some parts of the body, and after some space of tyme, these old enemies creeping out of their ambushments, assaulted nature afresh; which is very probable by those many indispositions and diseases which people fall into after they have had it, of which consequent infirmities many dye; and what these diseases commonly are I shall mention now in this next and last chapter.

CHAPTER XXVII.

OF THE MANY EVILL RELIQUES AND CONSEQUENT DISEASES WHICH FOLLOW A PLAGUE.

The Plague is like the Serpent with two heades, for it kills at both ends, but neither Diemerbrook nor others have wrote one word of the ill effects which a Plague leaves behind it. Many sorts of venomes doe the like, both minerall, vegetable and animall. I have beene certainly informed of two gentlemen being bitten by adders, both of them continually broke out with a dry Itch for 2 or 3 yeares, and then dyed of consumptions. The common diseases that the Plague carryes in its Tail are these. Extreeme paines in the backe, hipps, shoulders, heade, armes, great and painfull swellings in the shoulders, breast, leggs, thighs, losse of limbes, soare eyes, lamenesse, intollerable Itch, pimples, swelling of the yard. Alopecia, impostumes in the head, scurfes and inflamations, little red superficiall pimples in clusters like nettle stinging. Blindness, Feavers, Deafness, consumptions, forgettfullness, Toothach, excrescences;—there is not any of these which I have named,

but I have seen many of them this yeare, which have handled the Patient worse then the disease by far. Some have layne a quarter of a yeare of intollerable paine in the backe and then dyed, others of as great and constant paine in their heads and then dyed, others soe miserably plagued with the Itch they have torne their skin off their flesh. Others become quite deafe, others ever lingering fall into consumptions, and are cured by Death. Their hair coming off was common, soe was the swelling of the yard towards the glans. I had one patient dyed of a paine in her backe long after she had beene up of the disease, another that dyed of a great paine in his head, and had not beene free of it for three monthes. Another haveing had a long tyme a great paine in his head, at last an Imposthume brake out, and run out at his mouth.

Now as to the causes of these diseases it is easy to attribute all to the remainders of the old pestilent venome, which still lurkes in some corners of the body, and perhaps want of convenient skillfull purging after the disease may become occasion of some of them; yet I have seene some who have beene very laudably purged after the disease, yet fall into severall of these diseases. Yet how to cure and gett rid of these, I know not any other way but what is commonly used to each particular at other tymes, therefore I shall say nothing about it in this place.

Now at this tyme the great feare of the City is of another Plague this summer 1666, especially seeing wee have had this May 3 weekes together the Bills increasing successively, yet mee thinkes if they lay all arguments together they may find reason enough to bee of my mind, which is that the Plague hath a long Taile, but yet it will bee goeing backwards and forwards in little increases and decreases till it bee quite gone.

CHAPTER XXVIII.

SOME OBSERVATIONS THAT COULD NOT BEE CONVENIENTLY PUT INTO THE FOREGOEING CHAPTERS.

1. Towards the latter end of the Plague, many people that stay, and others that returne have little angry pustles, and blaines riseing upon them, especially upon the hands, without being sick at all, but such never dye, nor infect others. And I remember Diemerbrooke saith hee had a Carbuncle (as hee called it) upon his hand at the latter end of the Plague, which hee judgeth hee caught by going to one Patient after the

Plague was done, but I believe hee mistakes in thinking that hee caught it, for surely it was only one of those things which commonly happen, and sure it was but a blaine (but hee puts all under the name Carbuncle) for I saw noe Carbuncles on the hand all this plague tyme but only Blaines, yet many Carbuncles on the legs.

2ly. Blaines and Buboes come upon many people without makeing them sick, but Carbuncles seldom or never, which proves that Diemerbrooke's was only a blaine, for hee was not sick with it.

3ly. Besides a blaine, there is a thing you may call a blister, puffing up the skin long like ones finger, in figure like a Blister raised with Cantharides, and such usually dye.

4. In the West Indyes they set Cupping glasses 4 or 5 to the back to draw blood, and the Egyptians rub the leg, then bath it, then bind it, then slash it in 30 or 40 places, and draw out about 2 Pints of blood, with what success I know not. But the Turkes neither take physick nor fly for it, but attribute all to inevitable fate.

5. Many people are afraid at this tyme of the disease returning this summer, but my judgment is that such a thing will not bee, but now and then there may bee some little increases, it may bee for some weekes together, which may bee occasioned by the first approaching of hott weather, dilating, drawing forth and spreading some of the old fumes remayning still unextinct in some odd places. But I believe, if wee had had a very cold pinching winter there had beene very little of the disease remaining at this tyme, being the month of May, though I believe it must now bee next winter's work to bee thoroughly discharged of it.

6. Those that bled fresh at the nose, at the beginning of the disease, and those that had their courses much at the begining and soe continued, many of these did well; but they that after 2, 3, or 4 dayes lying sicke, bled only a little at one nostrill fared ill; yet this is noe warrant for any one to let blood, at the beginning of the disease, to cure.

7. Old people that had the disease, many of them were not sicke at all, but they that were sicke almost all dyed. I had one patient four score and six yeares old.

8. The spotted Feaver is allwaies rife in a Plague tyme, which I suppose makes many people say that severall have lived of the Tokens, and that boy, which Diemerbrook saith lived of the Tokens, was I believe only the spotted Feaver. These spotts are red, small and thicke, coming out first about the necke, then the armes and brest; I had many patients of it last summer, 1665, and but few dyed.

9. Diemerbrooke saith that Birds kept in cages dyeing, the people of that house dyed presently after.

10. None dyed without being sicke, though many said that an houre or half an houre before they dyed they were not sicke, and hardly any dyed under 20 or 24 houres being ill, though some authors say that in some countryes some people were struck suddenly dead with it. And Diemerbrook reckons one soe served with the smell of excrements.

11. The Good and bad fared all alike, and if any fared worse I thinke it was the Good. Perhaps God will put noe difference in common things, that it might not bee an occasion of envy and repining, as Solomon saith all things fall alike to all, and therefore noe man knowes good or evill by all that is before them; and in this point Jacob committed an error concerning Joseph in his parti-coloured coat testifying his affection to him above his brethren, which wrought their hatred against him, and was the cause of the evill and good that followed.

12. Diemerbrooke saith about the full Moone the plague raged most, but here the plague was not soe serviceable to the Moone, for the Moone went its course and the plague its course.

13. Of all the common hackney prostitutes of Luten Lane, Dog Yard, Cross Lane, Baldwin's Gardens, Hatton Garden, and other places; the common Cryers of Oranges, Oysters, fruite, etc.; all the impudent, drunken, drabbing Bayles and fellowes and many others of the Rouge Route, there is but few missing; verifying the testimony of Diemerbrooke that the plague left the rotten bodyes, and took the sound.

14. Authors speake of severall kinds of Plagues which tooke only children, others maids, others young people under thirty, but this of ours tooke all sorts, yet it fell not very thick upon old people till about the middle or slake of the disease, and most in the decrease and declining of the disease.

15. Catts, Doggs, Oxen, Horses, Sheepe, Hoggs, Conies, all wild beasts, Hens, Geese, Pigeons, Turkies, etc., and all wild fowle were free from infection.

16. Great doubting and disputing there is in the world whether the plague bee infectious or catching or not, because some think if it were infectious it would infect all, as the fire heates, and heates all it comes neare, but the plague leaves as many as it takes, thus are they gravelled at such arguments, and cannot solve their doubts; and Van Helmont thinks all people catch it by feare, and generally everyone is apt to judge by his experience, for if they have beene in never

soe little danger, and yet have escaped without catching it, they presently think the disease not infectious. Now if anyone may draw his conclusion from this, I have as much reason almost as any to think it is not infectious, having passed through a multitude of continuall dangers *cum summo vitæ periculo*, being employed all day till ten a clocke at night, out of one house into another, dressing soares and being allwaies in their breath and sweate, without catching the disease of any through God's protection, and soe did many Nurses who were in the like danger. Yet I count it to bee the most subtile infectious disease of any, and that all catch it not by feare neither (though this doth much as Helmont thinks), for then children and confident people would not have the disease, but wee see many of them also have it, and children especially most of any.

17. It hath beene observed that great plagues have commonly followed Earthquakes, and opening of the earth, as that first plague wee read of in Scripture (unlesse you count that Death of the first born in Egypt to bee one) that Moses speakes of, that followed upon the Earth's opening and swallowing up Korah and the rest, and another great plague at Venice which followed after a hideous Earthquake, and so unpeopled the place that they were forced to send for inhabitants to live there for nothing; as in Mr. Howell's History of Venice is to bee seene, which helps to prove a plague arises *ab infra*, et not *de supra*.

18. The Plague is like an Ague at the beginning and the Lues Gallica at the latter end.

19. One way of Cure will not serve for all, but wee must doe as contingencyes and circumstances doe divert us.

20. By continuall following of one course, occasion is given to every Mountebanke, tradesman and ignorant old woman to practize.

21. Whatever particular method you make to become generall many will live of it, but more dye.

22. I was told by an auntient woman that in Somersetshire the spotted feaver was very epidemicall, soe that whole familyes dyed of it, but being told that plantain was very good, all of them almost tooke it, which wrought an admirable change, for very few dyed that tooke it, whereas before they dyed very fast. I know noe reason why one may not give creditt to this relation, seeing for aught anyone can prove, it is as likely to effect such a cure as higher prized Medicines, and I should trust it before Pearl, Bezoar, or Gascon powder.

23. Wormes (which Diemerbrook saith many of his Patients

had and dyed with) were very rare here in this Plague, for I saw not any at all, nor heard of but one, which was a neighbour's child in S. Giles, which vomited one worme and voided another by stoole. The child's mother being told by a woman her neighbour that Tansey was very good for the worms, she gave it the juice of Tansey twice, but the child dyed in 6 or 8 houres after voiding the wormes. And I perceive by many circumstances which I gather from Diemerbrook's writeing that the Plague at Nimuegen which hee writeth of was far more mortall then this of ours, there dying ten thousand in that City, which I believe is not soe bigg as the tenth part of London and the Suburbs; yet I judge not by this argument only.

24. A generall flux with vomiting and gripping of the Guts, followed next Summer after the Plague, viz., Anno 1666. This flux seized on all sorts of people.

25. The whole kindred dying of the Plague, were commonly taken all alike, affected alike, proceeded in their sickness alike, lay the like tyme and dyed alike.

26. Some being taken at first with very bad signes, as stupefaction of senses, unwillingness to speake, speaking quick, inward and short, remain soe the first day, but next day the disease makes a retreate, they come to themselves, are lively and talke freely, but the same day in the afternoon they fall ill again, and by midnight are dead with the Tokens.

27. They that at the beginning of the disease complain of a paine in their back seldome live.

28. When the disease seizeth people violently at first as with convulsions, swooning fits, blindness, vehement headache, stupefaction of senses, such seldome live about two dayes.

29. Frettfullness, fuming and snarling is a signe of Death in the Plague.

30. The Disease absconding itselfe, and noe certaine signes appearing till 3 or 4 dayes bee over is an ill signe.

31. Risings spreading flat low, white, late, are evill signes.

32. People having hollow eyes commonly dye of the disease.

33. Those that dye having soares or risings lye longer than those that have none.

34. Noe signe is infallible but the Tokens, though many predict extreme danger, as a faultring voice, intermitting pulse, stopping at Stomach, etc.

35. The Summer following the Plague very few Flyes, Frogs and such like appeared.

36. They that catch the disease by easy and slight

occasions, as by feare, seldome live, especially if sudden feare seize them.

37. They that lye but little while sicke and dye with the Tokens, dye a far easier death then those that continue long sicke, or dye upon the relapse of a feaver.

38. The Plague generally begins at the West and the Southwest parts of Townes and Cityes, and commonly in little low poore houses.

39. It is difficult to give judgement upon old people, the disease acts soe sluggishly upon them.

40. Strong and young people dye sooner in the Plague then old and weake.

41. As soone as any house is infected all the sound people should bee had out of it, and not shut up therein to bee murdered.

42. The Plague falls on old people most in the Autumne.

43. The Plague mightily overthroweth the strength and spirits of the strongest bodyes in a little tyme, as a day or two.

44. They that in the Plague fall into a looseness within 2 or 3 dayes, their excrements are as black as Inke, and they generally all dye.

45. When the Plague is got into the Country sometymes it continues 8 or 10 yeares straggling up and downe from City to City and from Towne to Towne.

46. After the Plague, in the two succeeding winters, the Small Pox was exceeding rife, and bastard Pleurisies, and straitness of the brest and wheezing, with difficulty of breathing killed many.*

* In these "bastard Pleurisies", with respiratory troubles, we ought probably to recognise the Influenza, of which epidemics are distinctly traceable about this period. Whether the flux mentioned above (24) was Dysentery, or merely an epidemic diarrhœa, it is difficult to say.—EDITOR.

The Ordinary Meetings of the Society are held at

11, CHANDOS STREET, CAVENDISH SQUARE,

ON THE THIRD FRIDAY OF EACH MONTH FROM NOVEMBER TO MAY INCLUSIVE, UNLESS OTHERWISE ANNOUNCED.

THE CHAIR IS TAKEN AT EIGHT O'CLOCK P.M. PRECISELY.

Subscriptions may be paid to the Treasurer. The Annual Subscription of Ordinary Members is One Guinea.

Ordinary Members are entitled to all privileges of membership, and to receive a copy of all the Society's publications issued during the year for which their subscriptions are paid. But Ordinary Members, resident beyond the limits of the Metropolitan Postal District, and having paid one or more annual subscriptions, may, on expressing a wish to that effect, be distinguished as Non-Resident Members.

Non-Resident Members are liable to an annual payment of half-a-guinea. They have the privilege of attending meetings, and are entitled to receive the publications of the Society issued during the year for which their subscription is paid; but they are not entitled to vote at meetings of the Society nor to hold office in it.

The Rules and Regulations of the Society, with an Exposition of its Objects, may be obtained from the Secretaries.

The Transactions for the Sessions 1859-60, 1866-67, *and* 1867-68 *are out of print. With these exceptions, those for the Sessions from* 1860-61 *to the last Session inclusive, may be obtained from the publishers,* Messrs. SHAW AND SONS, FETTER LANE, E.C. *Prior to* 1859-60, *the Transactions were published in the "*SANITARY REVIEW." *The issue of a New Series of the Transactions was begun in* 1882.